The Chemical Age

VOL LXII 25 MARCH 1950 No. 1602

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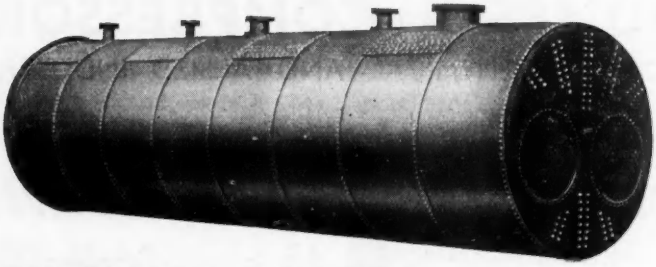
STORAGE TANKS



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1	24 ft. 0 in.	5 ft. 6 in.	7/16 in.	3,500
1	24 ft. 0 in.	5 ft. 6 in.	5/8 in.	3,500
1	22 ft. 0 in.	6 ft. 6 in.	1/2 in.	4,500
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1	28 ft. 0 in.	5 ft. 10 in.	1/2 in.	4,800
1	28 ft. 0 in.	6 ft. 0 in.	7/16 in.	4,900
1	24 ft. 0 in.	7 ft. 0 in.	1/2 in.	5,700
1	28 ft. 0 in.	7 ft. 0 in.	7/16 in.	6,700
1	26 ft. 0 in.	7 ft. 0 in.	5/8 in.	6,700
1	25 ft. 0 in.	7 ft. 6 in.	1/2 in.	7,000
1	27 ft. 0 in.	7 ft. 6 in.	7/16 in.	7,450
3	30 ft. 0 in.	7 ft. 0 in.	1/2 in.	7,200
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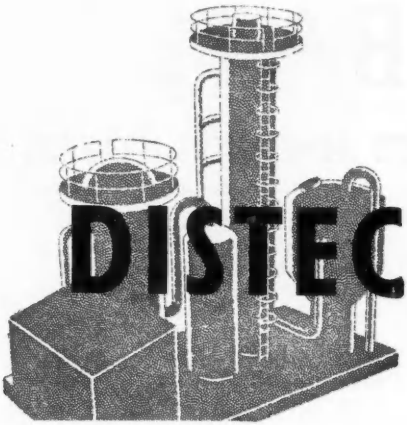

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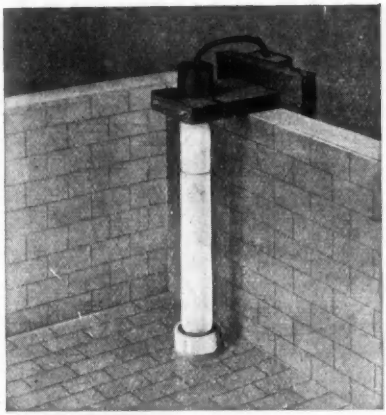

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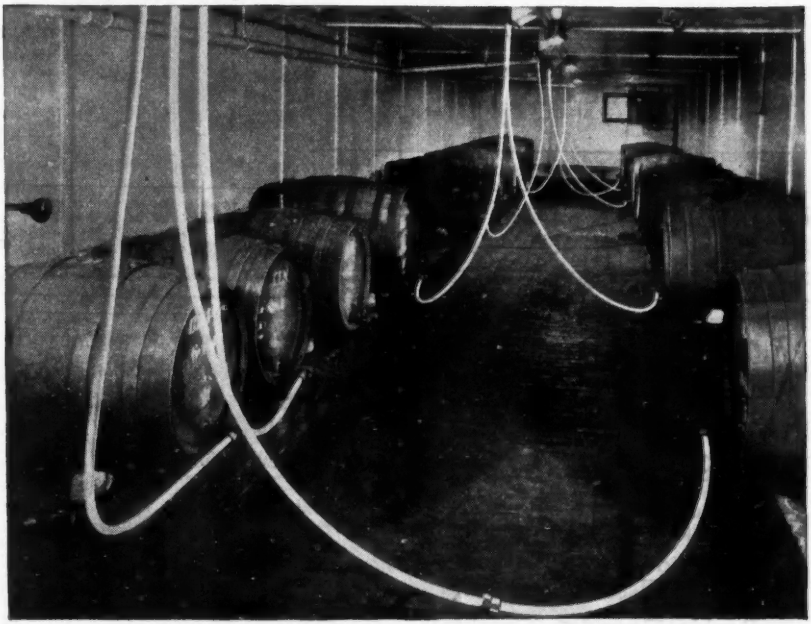
beer through 'ALKATHENE' tube

By courtesy of Ansells Brewery.



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P.368

The
Chemical Age

The Weekly Journal of Chemical Engineering and Industrial Chemistry

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Monopoly Hunting

TO all liberal-minded persons monopolies and restrictive practices are detestable. The terms alone invoke visions of the grosser forms of undeserved privilege of whose existence there was no doubt at all in the comparatively recent past. There may exist even to-day some vestigial reminders of Royal prerogative, by which exclusive rights to deal in some more or less essential commodity might be granted to an individual for cash or services rendered. If there are, their effects would not be of the sort which inspires a public demand for reform and it is certainly not to sweep away any such picturesque anachronisms that the Monopolies and Restrictive Practices Act (Inquiry and Control) was given effect in the House of Commons in July 1948.

The operation of this Act is the subject of a report, the first of an annual series, just issued by the Board of Trade, which in this regard holds the ultimate responsibility for sifting the evidence that there exists a case meriting investigation. The Board of Trade is expected to indicate where the quarry lies, but the task of running down the monopoly and possibly arranging for its dismemberment rests with the Monopolies and Restrictive Practices Commission, a council of eight, including, as chairman, Sir Archibald Carter, K.C.B., K.C.I.E. The chairman receives a salary of £5000 a year and this, and the £7500 disbursed in varying proportions to the others, is certainly not money easily earned. Monopolies and restrictions of full production or distribution do not advertise their existence, and when the Board of Trade claims to have discerned one or the other, the M and RP Commission's task of determining whether this is a case in which in the public interest Parliament should intervene would seem to call for most of the qualities of a High Court judge and an economist, and rather more realism than either judges or economists habitually exhibit.

In view of the complications of this modern form of witch hunt, it would be ungenerous to complain that the commission has not yet laid bare one case of disreputable combination or monopolistic plot, the existence of which was not doubted by those who piloted the Bill through the House. It has, however, certainly not been idle, for the Board of Trade has put up six subjects for its investigation, and chose them to cover a wide range of different types of activity, "so that the commission's first reports should enable a considerable section

On Other Pages

The annual subscription to THE CHEMICAL AGE is 30s.; single copies, 9d.; post paid, 1s. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited

of industry to work at its trading practices in the light of authoritative judgments." The six chosen are all concerned with supply (as opposed to production) and relate to these goods: Dental goods, electric lamps, electric wires and cables, watch-making machinery, matches and exports of matches, and builders' castings made of cast iron (gutters, water pipes, etc.).

Comment on any of these cases would be out of order, but from the terms of the Act it follows that the Board of Trade suspects that the supply or export arrangements of one-third of the total production of each of these classes of goods are the subjects of restrictive practices. In the instance of electric lamps that belief is shared by the Co-operative Union, whose Parliamentary Committee has been active in this and some other cases of supposed restrictive practices. Independent requests that the Board of Trade should investigate the possibility that normally competitive conditions are being repressed in any industry are, of course, an essential feature of this legislation, so that the Board is unlikely to have much difficulty in finding further material for inquiry. Most of these recommendations to the Board have related to impediments which associations of distributors or manufacturers, generally the former, are alleged to have placed in the way of non-members seeking to participate. Withholding supplies or offering unfavourable discounts to dealers have been alleged. In that category fall nine classes of trade, among them chemists' goods, galvanised hollow-ware, laboratory equipment, plate glass, cement and tea seed oil. All have been "cited."

One of the unanticipated results of the first year's operation of the Act is the relatively small attention paid to "chemicals," which Left-wing propaganda has often sought to represent as the natural sphere of monopolies. "Chemicals," Calor gas and medical and industrial gases have in fact been mentioned as deserving investigation. The Board, which since the autumn of last year has had before it the Association of British Chemical Manufacturers' comprehensive review of some principal chemical industries, has not given "chemicals" the priority some would like. The Board might conceivably have taken the view that some of the "giants" of the industrial landscape are as important for a sound economy as were the windmills against which Don Quixote broke his lance.

Notes and Comments

Few Chemicals for India

THE performance of chemical export trading groups last month appears to reflect a rising level of activity, which is not immediately apparent to the cursory view, seeing the February total of chemical export sales only in its relation to the January figure. The total of £6,851,945 in the 24 working days afforded by February provided over £100,000 more than was secured in February a year ago. The quality of that achievement can be fully appreciated when it is noted how heavy have been one or two recessions in traditional sources of revenue, of which the Indian market is the outstanding example. Within 12 months India's monthly purchases of U.K. chemicals—"chemicals, drugs, dyes and colours"—have contracted by over £800,000, to £277,247. There were, for example, in February no sales of sodium carbonate or caustic soda (which together realised over £137,000 a year before), and Indian purchases of nearly every other class of chemical material were correspondingly cut. Indian home production, meanwhile, is still conspicuously ill equipped to fill the gaps.

Wartime Sacrifices

THE effect of war upon chemical industries is a recurrent theme, which day-to-day events make hard to ignore. It was, not inappropriately, one of the matters to which Sir Frederick Bain invited the attention of the Canadian members of the SCI and the Chemical Institute of Canada when he spoke as a guest of honour in Montreal last month. The deputy chairman of I.C.I., Ltd., made very clear to the Canadian chemists what is no doubt occasionally forgotten when comparisons are made outside this country of the phenomenal rate of advance in technology and industry in North America and what has been done here. He recalled to them that not only were U.K. chemical industries and their research departments in battle dress for six years, but they deliberately relinquished to the American countries many projects which have yielded to others results of world-wide importance. Among the many historic examples of that policy is one which is frequently overlooked, the genesis of large-scale production of synthetic rubber. That, Sir Frederick Bain indicated, might now be a flourishing industry in Great Britain had it not been deemed better strategy, when Malaya fell, to leave to the U.S.A. and Canada the whole responsibility for the development and production of speciality and general purpose rubbers. The rightness of the decision at that time, observed Sir Frederick Bain, did not alter the fact that it had left a gap in our industry which must remain unfilled "for some time." He did not disguise his conviction, however, that all such voids in the programme of British chemical industries were not going to be permanent. Recalling that he had more than 40 years' experience in those industries, he told his Canadian audience: "I have seen good times and bad times. I have seen a complete revolution in the methods and the processes of the industry. Never have I seen it so alive to the new knowledge that is pouring in from the laboratories of the world. I have never known all ranks of our industry to work so hard."

Atomic By-Products

THE impression which becomes increasingly hard to repel, although it is probably false, that most practical benefits of atomic energy research are likely to be reserved for the next generation does not gain much support from the current report of the U.S. Atomic Energy Commission. This is the seventh semi-annual survey of the vast American programme, to which $81 million is being devoted this year, to pursue all the far-ranging investigations associated with nuclear fission. It shows how intimately these studies

now affect practical and fundamental concepts of chemistry and metallurgy. It invites the conclusion that, however nebulous may be some of the anticipated results of nuclear fission as a power source, the incidental discoveries can hardly fail to open up new vistas in more practical techniques, related to such subjects as chemical separation and analysis, thermodynamics and corrosion. Metallurgy, in particular, is capable of receiving new knowledge from the current examination in the U.S.A. of metal atomic structures, the influence of radiation on mechanical and electrical properties, and possibly great practical advances when the present endeavour to establish the basic nature of corrosion is complete. The last has a separate backing from the U.S. Navy's research departments, while the AEC has narrowed its studies to one or two metals, notably zinc and titanium.

Wide Horizons

CHEMISTS and other scientific people have been invited once more to ponder the need for present-day scientific workers to liberate themselves from the rigid bonds of specialisation. The renewed approach was made by Professor John Read, of the University of St. Andrews, in the Pope Memorial Lecture at the Royal Society of Arts this week. He, like most others on the same subject, cited as an example of emancipation, one whose great spiritual and intellectual endowment distinguished him very markedly from most of his contemporaries, Sir William Jackson Pope, the Cambridge professor of chemistry whose contributions in stereochemistry alone opened up new horizons. Sir John Read, however, offers something more realistic than the conventional conclusion that culture must be added to scientific study rather like a decorative embellishment. His theme, "Chemistry as an Instrument of Culture," made effective use of the possibilities of the widest kind of intellectual activity within the framework of chemistry and its widespread points of contact with most other human activities. The alchemists, on whom he is the recognised authority, were often classic examples of the capacity for relating most human and celestial things to their own line of thought. The circumstance that their own peculiarly specialised study, the quest for the great transmuting agent, went unrewarded, cannot fairly be held against them in view of the great advances of natural philosophy, as well as practical techniques, which they fathered. Those who are sceptical about the prospects of an intellectual renaissance in chemistry and the sciences may find discouragement in the fact, recalled by Professor Read, that Sir William Pope's unique record of alchemy, his precious collections of paintings and engravings, now rests in the Fisher Scientific Company's collection—in Pittsburgh, Pennsylvania.

Heraldry

THE capacity of large commercial interests to foster things which have no evident link with business is fortunately not peculiarly American. Further evidence of this is the new publication on "The Colour of Chivalry," in which fine colour plates by Gerald Cobb, miniaturist to the College of Arms, and text by Harold Periera, are magnificently presented between gold covers. I.C.I., Ltd., were responsible for this. It presents vividly and accurately richly decorative examples of amorial bearings originally reproduced for publication in overseas periodicals to make known I.C.I.'s capacity as a producer of pure colours. The book will not be sold or otherwise made available to the public, but is being presented to history tutors at the universities and to schools and art schools throughout Great Britain.

U.S. BUYS FEWER CHEMICALS

FOR the third consecutive year, U.S. imports of chemicals and allied products have dropped in dollar value. In 1949 they reached the post-war low level of $230,366,000, compared with $276,377,000 in 1948, and the high record figures of $323,259,000 in 1947. Against this, U.S. exports of chemicals in 1949 are recorded as being 370 per cent more than pre-war.

INDIA'S SODA ASH

Import Duty and Subsidy

THE Government of India has accepted the recommendations of the Tariff Board to grant protection to the soda ash industry for a period of three years, to March 31, 1953.

In view of the fall in the landed cost of imported soda ash, which has occurred since the Tariff Board submitted its report, the duty on soda ash will be increased to 40 per cent *ad valorem* if the manufacture is of a British colony, and 50 per cent if the manufacture is of any other country.

The Government has accepted the principle of a subsidy and considers that this should be Rs. 1 per cwt. This will be granted on soda ash produced by the specified Indian companies and sold from the date of this order.

The Minister of Commerce, Mr. K. C. Neogy, said in the Dominion Assembly at New Delhi, that the gaps between supply and demand in 1948-49 were of the order of 60,000 tons of caustic soda and 50,000 to 60,000 tons of soda ash. The indigenous soda ash factories produced only light ash which was said to be unsuitable for the manufacture of glass and silicate. These industries required heavy ash which had to be imported from abroad, unless the glass furnaces and equipment were adapted to the use of light soda ash.

The indigenous production of caustic soda, said Mr. Neogy, was less than 10 per cent of India's total requirements. After taking note of the present stock position and considering the views of the manufacturers concerned, it was decided to allow imports of 25,500 tons of caustic soda during January-June, 1950.

(*Board of Trade returns show there have been no exports of sodium carbonate and caustic soda to India this year.*)

ANTIBIOTIC RESEARCH

New Laboratories and Pilot Plant

ANTIBIOTIC research laboratories and pilot plant are being set up by Glaxo Laboratories, Ltd., in a large mansion at Sefton Park, near Stoke Poges, Bucks. The new research unit will be wholly concerned in finding and developing new antibiotics and will be in operation later this year.

The property, which occupies 28 acres, was once the home of Lady de Frece, better known as Vesta Tilley, the famous music hall artiste. Previously the estate had been owned by the Decies family and also by the Oppenheimers.

On the ground floor of the mansion (formerly the home of Lady de Frece) three main chemistry laboratories will be constructed and there will be refrigeration and balance rooms and suitable accommodation for ancillary services. The first floor will be occupied by microbiological laboratories, incubation and sterile rooms and executive offices. Adjoining the main building a pilot plant and boiler house are being erected on the site of the original coach houses and outhouses.

The new departments implement the policy mentioned by Sir Harry Jephcott in his recent annual review of the company's affairs: "Only sustained research and its industrial application can ensure that these factories (Barnard Castle and Ulverston) combine to compete successfully in the world's markets with the very large output of the flourishing United States antibiotic industry."

The Barnard Castle (Co. Durham) factory of Glaxo Laboratories, Ltd., which has been engaged in streptomycin production since 1946, has reverted to the manufacture of penicillin. It will henceforth be largely concerned with secondary products of penicillin and their packaging.

Penicillin to be Manufactured in India

AT the recent annual session of the Indian Chemical Society, at Poona, Dr. J. N. Ray, Deputy Director General of Industries and Supply, Government of India, emphasised the need to develop India's technical manpower for her industrial advancement.

He said the Government had decided to start the manufacture of penicillin as a State enterprise with the co-operation of a foreign firm. The initial capacity would be 1200 billion units per year with a provision to increase it to 3600 billion units, if necessary. The manufacture of sulpha drugs and synthetic anti-malarials would also be undertaken in the same factory. The collaboration of a foreign firm had also been obtained for the production of para-amino-salicylic acid, the new curative agent in the treatment of tuberculosis.

Three firms had been granted licences for the production of acetic acid and acetic anhydride. The aggregate production would be 3000 tons per annum, more than India's present requirements. A British firm had surveyed the possibility of the manufacture of industrial explosives in India and the scheme was under the Government's consideration.

SCOTTISH-U.S. LIAISON

U.S. Products for Empire Markets

SOME 400 Scottish firms, mainly in the technical field, engineering and chemical processing, have indicated readiness to co-operate with American or Canadian firms to produce, under licence, North American goods in Scotland. The Scottish Council is organising the scheme, which promises to continue a system which has already conferred benefits in Scotland.

The intention is to offer suitable contacts with North American and Scottish firms to produce goods or products which are not now made here and for which a British Empire market exists.

The Scottish Council is also sponsoring the launching of electronic industry development in Scotland. Some 15 firms are represented on a body which is being formed to discuss large expansion of this industry in Scotland.

Borax Chemicals Recovery

THE further decline in trading profits of Borax Consolidated, Ltd., for 1949 was attributed by the company's chairman, Mr. D. Abel Smith, almost entirely to the course of domestic trade in the U.S.A. and Canada. He was speaking at the annual general meeting of the company in London last week.

A recession had set in during the spring, said Mr. Smith, which many had thought would become a slump. This had influenced the glass and enamel industries, in particular, causing a decline in sales. The recession had, however, the beneficial effect of reducing stocks of finished goods, and soon gave way to a recovery.

A satisfactory note of prosperity had closed the year's trade in the U.S.A.

The company's home and other foreign sales were maintained on about the level of the previous year, and the Government control exercised over the industry in the United Kingdom during the war years and after was largely terminated on April 1, 1949, the chairman said.

Fixed assets abroad—mines, properties, buildings, plant and machinery—figured in the balance sheet in sterling at the rates of exchange in force at the times of acquisition; they remained unaffected by subsequent fluctuations of exchange rates.

I.C.I. Plans Approved

Plans for the further extension of the existing I.C.I. factory were considered by Grangemouth Dean of Guild Court, last week and approved. These form part of I.C.I's five-year expansion programme.

ROYAL SOCIETY FELLOWS

Chemists and Physicists Elected

THE following scientists associated with chemistry or physics were among those elected to fellowship of the Royal Society at its meeting on March 16. The work for which each is particularly distinguished is shown in parentheses after the name :—

BATES, Leslie Fleetwood. Professor of physics, University of Nottingham. (Experimental physics, particularly researches on the properties of ferromagnetic substances.)

BENNET-CLARK, Thomas Archibald. Professor of botany, King's College, London. (Plant physiology, particularly on organic acid metabolism, and the control of water in plant cells.)

BLEANEY, Brebis. Demonstrator and lecturer in physics, Oxford University. (Experimental physics, especially microwave spectroscopy and low-temperature physics.)

COULSON, Charles Alfred. Professor of theoretical physics, King's College, London. (Application of quantum theory to chemical problems.)

ELFORD, William Joseph. Biophysicist, National Institute for Medical Research, London. (Viruses, particularly methods of determining virus size.)

HOWARTH, Leslie. Professor of applied mathematics, University of Bristol. (Mathematical theory of the boundary layer, the theory of isotropic turbulence and gas dynamics.)

JONES, Ewart Ray Herbert. Professor of organic chemistry, University of Manchester. (Organic chemistry, particularly in the fields of steroids, carotenoids and the chemistry of acetylene.)

MARTIN, Archer John Porter. Biochemist, National Institute for Medical Research, London. (Development of liquid-liquid partition chromatographic methods of chemical analysis.)

MORTON, Richard Alan. Professor of biochemistry, University of Liverpool. (Chemistry and biochemistry of the fat-soluble vitamins.)

SHENSTONE, Allen G. Professor of physics, Princeton University, U.S.A., formerly scientific liaison officer in London of the Canadian National Research Council. (Spectroscopic researches.)

STACEY, Maurice. Professor of chemistry, University of Birmingham. (Organic chemistry, especially studies of the carbohydrates of animal tissue and of micro-organisms.)

SUTTON, Leslie Ernest. Demonstrator and lecturer in physical chemistry, Oxford University. (Electrical properties of molecules.)

SYNGE, Richard Lawrence Millington. Biochemist, Rowett Research Institute, Aberdeenshire. (Application of the principle of partition chromatography to the separation of amino-acids and peptides.)

Spain to Produce More Nitrate

THE need to establish an efficient home fertiliser industry in Spain is likely to be met in part by the operation, which began this month, of the nitrate factory, Nitratos de Castilla, Valladoid.

The factory is to produce 32,000 tons this year and has as its target 64,000 tons for 1951, states a report on Spanish industries recently issued by Señor Suanzes, Minister of Industry and Commerce.

Domestic agricultural requirements of nitrate are estimated by the minister at 600,000 tons a year and it is hoped that production will be increased to supply this amount during 1951-53.

FEBRUARY CHEMICAL EXPORTS

£1m. Less Than January's Total

WITH a total of £6,851,945, exports of chemicals, drugs, dyes and colours in February were worth about £1 million less than in January (£7,984,581), yet they showed a comparatively small increase over February 1949 (£6,737,432). Individual items recording the principal decreases in the month (January figures in brackets) were: Cresylic acid £30,392 (£53,714); salicylic acid and salicylates £9,540 (£14,905); ammonium sulphate £244,705 (£542,345); bleaching powder £16,891 (£24,747); lead acetate, litharge, red lead, etc., £22,866 (£47,469); tetra-ethyl lead £228,502 (£266,564); magnesium compounds £25,906 (£37,762); salt £121,984 (£157,225); sodium carbonate £138,773 (£164,870); caustic soda £217,106 (£292,490); tar oil, creosote oil, anthracene oil, etc., £39,493 (£148,788); quinine and its salts £12,678 (£43,738); acetyl-salicylic acid £24,143 (£64,754); insulin £21,286 (£41,744); penicillin £173,637 (£273,273).

EXPORTS

	Feb., 1950	Feb., 1949
	Gal.	Gal.
Cresylic acid	152,396	120,918
	Lb.	Lb.
Salicylic acid and salicylates	76,252	147,471
Value of all other sorts of acid	£127,111	£96,171
	Tons	Tons
Sulphate of alumina	2,482	2,866
All other sorts of aluminium compounds	530	1,420
Ammonium sulphate	13,522	14,792
Ammonium nitrate	10,333	10,107
All other sorts of ammonium compounds	1,143	1,654
	Cwt.	Cwt.
Bleaching powder	16,033	34,799
All other bleaching materials	9,947	10,214
Collodion cotton	1,465	2,283
	Tons	Tons
Copper sulphate	4,531	1,962
	Cwt.	Cwt.
Disinfectants, insecticides, etc.	29,533	37,845
	Tons	Tons
Fertilisers	1,832	2,192
Value of gases (compressed, liquefied or solidified)	£30,186	£30,763
	Cwt.	Cwt.
Lead acetate, litharge, red lead, etc.	3,914	5,914
	Gal.	Gal.
Tetra-ethyl lead	114,920	92,217
	Tons	Tons
Magnesium compounds	557	751
	Cwt.	Cwt.
Nickel salts	6,815	3,195
Potassium compounds	7,746	6,528
	Tons	Tons
Salt	15,831	13,665
	Cwt.	Cwt.
Sodium carbonate	245,304	324,348
Caustic soda	186,078	149,758
Sodium silicate	24,598	18,897
Sodium sulphate	35,162	48,315
All other sodium compounds	74,147	80,802
	Gal.	Gal.
Tar oil, creosote oil, anthracene oil, etc.	800,446	440,021
	Tons	Tons
Zinc oxide	1,438	1,176
Total value of chemical manufactures (excluding drugs and dyestuffs)	£3,847,586	£3,400,362
Value of quinine and quinine salts	£12,678	£30,721
	Lb.	Lb.
Acetyl-salicylic acid	132,936	81,488
	100 International units	100 International units
Insulin	552,122	1,198,804
	Mega units	Mega units
Penicillin	755,614	429,887
Total value of drugs, medicines and preparations	£1,338,644	£1,368,308
Total value of dyes and dyestuffs	£714,697	£1,002,767
Total value of paints, pigments, colours, etc.	£951,018	£965,995
	Cwt.	Cwt.
Plastic materials	45,458	30,224
Value	£504,675	£388,476
	Cwt.	Cwt.
Chemical glassware	985	1,149
Value	£38,156	£43,167
	Cwt.	Cwt.
Fans	7,732	5,027
Value	£169,551	£132,763
	Cwt.	Cwt.
Furnace plant	8,054	5,401
Value	£80,257	£59,279
	Cwt.	Cwt.
Gas and chemical machinery	23,500	21,050
Value	£313,077	£250,931

IMPORTS

	Feb., 1950	Feb., 1949
	Cwt.	Cwt.
Acetic anhydride	4,623	12,482
Acetic acid	—	—
Boric acid	11,900	4,868
Carbolic acid	—	10,199
Value of all other sorts of acid	£57,205	£60,557
Borax	23,000	26,700
Calcium carbide	38	7,377
Cobalt oxides	536	991
	Tons	Tons
Fertilisers	21,202	14,090
	Lb.	Lb.
Glycol ethers and glycol ether esters	352,749	328,998
Iodine	132,100	—
	Cwt.	Cwt.
Potassium chloride	342,912	459,259
Potassium sulphate	29,020	54,360
All other potassium compounds	11,249	9,512
Sodium nitrate	10,000	—
All other sodium compounds	10,724	4,582
Carbon blacks (from natural gas)	89,091	83,497
Value of carbon blacks	£378,891	£258,936
Total value of chemicals, drugs, dyes and colours	£2,634,346	£2,217,631
	Tons	Tons
Sulphur	25,975	29,695
Value	£248,187	£248,508
	Cwt.	Cwt.
Gas and chemical machinery	1,464	131
Value	£66,305	£10,713

INFLAMMABLE COATINGS

Railway's Views on Cellulose Lacquer

THE rapid spread of a fire on the Edinburgh-King's Cross express in June last year was stated to have been due to the clear cellulose lacquer with which the walls of the corridor had been sprayed.

Colonel R. J. Walker, inspecting officer of railways, who conducted the Ministry of Transport inquiry, found that the asphyxiating fumes in the coaches were nitrous gases, such as were to be expected when cellulose burns.

The coaches had been built for the LNER in 1947, and the railway company had specified the components, the oil-bound paints to be used.

The inspecting officer concluded that permission must have been given to use also clear cellulose and insufficient attention had been given to the inflammable possibilities of the additional material.

Immediate action had been taken to withdraw from service any other coaches known to have been sprayed with such material.

A Disclaimer

A representative of British Cellulose Lacquers, Ltd., has since expressed the view to THE CHEMICAL AGE, that cellulose lacquer of correct specification is not readily inflammable. It is being increasingly used as a finish on household and other goods. If, as stated in the report, the clear cellulose lacquer was largely responsible for the rapid spread of the fire, it must, he suggested, have been due to the faulty quality of the lacquer employed.

NEW BRITISH STANDARDS

Tubes for Petroleum Industry

TWO further documents in the series of British Standards which are being published for the petroleum industry have just been issued by the British Standards Institution.

These standards are for cold drawn seamless low carbon steel tubes (B.S. 1627) and cold drawn seamless alloy steel tubes (B.S.1628), both for heat exchangers and condensers for the petroleum industry.

Provision is made for one grade of low carbon steel tubes and two grades of alloy steel tubes in sizes from ½ in. up to any gauge less than 2 in. outside diameter. Details are given of the chemical composition and mechanical properties required, as well as methods of test and tolerances.

In view of the international character of the petroleum industry special consideration was given to standard A.179 and A.199 of the American Society for Testing Materials and to the advantage of securing interchangeability between American and British equipment.

Dimensions for spigot and socket and conical flanged stoneware pipes and pipe fittings for chemical purposes are the subject of another new British Standard (B.S. 1634).

The standard provides tables for standard dimensions for the following types of fittings: single and double 90° junctions; single and double 45° bends; equal and unequal tees and crosses. It also describes accuracy tests of conical flange fittings.

High Vacuum Equipment to be Shown in Canada

PROMISING to be an important part of the range of British scientific instruments to be exhibited in May at the Canadian International Trade Fair is the comprehensive selection of high vacuum equipment manufactured by W. Edwards & Co. (London), Ltd.

A pre-view of some of the most important exhibits was given this week to the technical Press and others at the company's modern works on the outskirts of London; this amply illustrated the rapid progress of high vacuum technology for industrial application during the past 10 years or so. A representative of THE CHEMICAL AGE was told that there is virtually no known aspect of that subject which the company is not studying. Work is also undertaken to design and manufacture plant to any individual requirements.

A full range of gauges has been developed for the measurement of high vacuum. For the measurement of the highest vacua in the laboratory a thermionic ionisation gauge has been developed, similar in principle to a triode vacuum tube. The gauge is highly sensitive, continuously indicating, and measures pressures from .02 to 10^{-8}.

A much simpler type is a small dial gauge which records from atmospheric down to 1 mm. pressures.

Interesting innovations in the company's vacuum coating technique include the model 6E coating unit for experimental work and the 12E evaporating unit for small scale production.

HOT SPRAYING CELLULOSE LACQUERS

Balancing Viscosity and Film-Forming Properties

by A. E. LAIN, A.R.I.C., M.P.S. *

THE chief film-forming component of lacquers formulated for hot spraying is a cellulose derivative, usually the nitrate. Modifying agents such as natural and synthetic resins and plasticisers of the solvent and non-solvent types are used to enhance such properties as film thickness, adhesion, toughness, gloss, and so on. The liquid portion of the lacquer usually consists of a mixture of solvents such as the acetic acid esters of the lower aliphatic alcohols or the lower homologues of the aliphatic and aromatic ketones.

Aliphatic and aromatic hydrocarbons and the lower alcohols, known as diluents, are also used, and form a not inconsiderable part of the volatile portion of a cellulose lacquer. They serve to reduce the cost and increase the solvent power of the mixture.

The cellulose lacquer film was formed after application by the evaporation of the various solvents and diluents, whereas synthetic stoving varnish and traditional-type oil varnish films harden by condensation and oxidation. As no chemical change takes place in the formation of a cellulose film, most of the film-forming components are materials of relatively high molecular weight and produce solutions of high viscosity in organic solvents.

Comparison with Resins

Clear cellulose lacquers of good quality for application under normal conditions therefore contain about 20-30 per cent of film-forming components, compared with 45-50 per cent or even more which is possible with the more recent synthetic finishes derived from urea-formaldehyde, alkyd resins or mixtures.

During the last 25 years considerable progress has been made in the manufacture of cellulose nitrates which yield solutions of lower viscosity. While resins generally produce lower-viscosity solutions than cellulose nitrate, the ratio of resin to cellulose nitrate which can be used without affecting the durability of the film is strictly limited.

Higher ratios of synthetic resins, for example, non-drying oil-modified alkyds or rosin-modified maleics, may be used when they replace resins such as dammer and ester gum, but very little increase in total solids results because synthetic resins of that type produce solutions of higher viscosity.

As cellulose lacquers are normally applied by a spray gun, the viscosity is important, for it sets a limitation to the percentage of film-forming components which it is practicable to spray. The efforts of manufacturers of cellulose lacquers are therefore constantly directed to increasing the total film-forming ingredients without sacrificing other desirable characteristics of cellulose solutions, such as hardness, durability, and so on.

Solvents and Solids

The lower molecular weight solvents, such as ethyl acetate, acetone and methyl ethyl ketone produce solutions of low viscosity with nitro-cellulose and resins, and it has been suggested that the solid content of lacquers of sprayable viscosity could be increased if the proportion of such solvents was raised. As those solvents evaporate so quickly, however, there is a considerable increase of viscosity as the lacquer passes from the spray gun to the article to be sprayed, and the solution should be sprayed at a lower initial viscosity. In consequence, some of the advantage in using such solvents is lost.

If a lacquer contains no low-boiling solvents, it is possible to spray it satisfactorily at a viscosity of 130 centipoises; on the other hand, if 12½ per cent of the liquid portion of that mixture contains solvents of that type, it is necessary to decrease the viscosity to 80 centipoises. If an adjustment of that nature is not made, the material, on striking the surface, would be insufficiently fluid to flow, and the "orange peel" effect would result. As it is necessary to add about 12 per cent solvents mixture to reduce the viscosity from 130 to 80 centipoises, the advantages of using low-boiling solvents are problematical.

Correct spraying viscosity is an important factor in the satisfactory application of cellulose lacquers. If a lacquer is heated in a closed container the reduction in viscosity is considerable. For example, a lacquer having a viscosity of 355 centipoises at 24° C. is reduced in viscosity to 80 centipoises at 60° C., a viscosity at

* Summary of a paper presented before the London Section of the Oil and Colour Chemists' Association on March 15.

which it was capable of being atomised with the spraying equipment normally available. Another lacquer having a viscosity of 270 centipoises at 23°C., has a viscosity of 60 centipoises at 60°C.

As it would normally require 30 per cent of thinners to reduce that lacquer to spraying viscosity, the application of the undiluted material results in approximately 33 per cent more film-forming materials being applied. One writer has claimed that a lacquer having the same viscosity at 71°C. as another at 27°C. would have 40-50 per cent greater solids content.

Thicker Hot Films

Hot spraying thins a high solids lacquer to spraying consistency. The application of cellulose lacquer at elevated temperatures undoubtedly results in the deposition of a thicker film or, alternatively, reduces the number of coats necessary to give the required film thickness.

The temperature at which hot lacquers are applied varies within considerable limits, but a temperature range of 66°-80°C. is usually employed. The manufacturer standardises the viscosity of the cold material so that when raised to a chosen temperature its viscosity is reduced to 80-100 centipoises.

The question of degradation of the cellulose component of the lacquer as a result of heating does not arise, since in modern plant the lacquer is not heated until it enters the coil and then is sprayed almost immediately. The reduction in viscosity due to heating ensures that the material is broken up into small globules in the spray cone.

A thermometer placed in the fan spray at various distances from the nozzle has shown that the temperature of the lacquers in the circuit was 76°C.; ½-in. from the nozzle it was 46°C.; 3-in. from the nozzle, 38.5°C.; 6-in. from the nozzle 31°C. The shop temperature was 26.5°C. The temperature of the air stream alone was found to be 21°C. on expansion; that of ordinary unheated lacquer was as low as 15°C. at 6-in. from the spray gun.

It is therefore evident that a heated lacquer, which would normally have a viscosity of 80-100 centipoises at 80°C., would have a viscosity, through cooling and loss of solvents, of considerably over 300 centipoises within a few seconds of striking the surface to be sprayed.

There is no evidence to suggest that the film-forming components of a hot lacquer should differ from a lacquer intended for use under normal conditions, except that they will be present in a higher proportion. The attention of manufacturers is therefore centred chiefly on the composition of the volatile portion of the material.

It has frequently been pointed out in the technical Press that the dilution ratio of solvents for nitro cellulose decreases with rising temperatures, and on that account the proportion of active cellulose solvents should be greater in cellulose lacquers for application at elevated temperatures.

There are, however, more considerations necessitating an increase in the active solvent content. (A solvent mixture rich in active solvents will in itself increase the proportion of non-volatile components of the lacquer for a given viscosity).

If the film is to present a smooth, bright appearance the particles must still retain a measure of fluidity. It is therefore usual, in formulating hot lacquer, to reduce or eliminate all low-boiling solvents and diluents such as ethyl acetate, acetone, toluol and methyl ethyl ketone, and increase the quantities of such solvents as butyl acetate and butyl alcohol.

One writer goes so far as to suggest that there were no upper limits to the amount of amyl acetate that could be used with advantage in a hot lacquer and considers that it might even serve as the sole volatile constituent. The minimum quantity is estimated to be 50 per cent. A solvent mixture rich in high-boiling active solvents for cellulose nitrate would also have a favourable influence on the amount of film-forming materials.

Time and Costs

The rate of drying and hardening is considerably affected by the thickness of the film deposited, and it is not surprising that hot lacquers should take longer to dry and harden than do those applied under normal conditions. For that reason the use of the extra high-boiling solvents such as cellosolve, ethyl lactate, methyl cyclohexanone, is undesirable if prolonged drying periods are to be avoided.

The film-forming constituents of cellulose lacquer are normally more costly than the volatile portion and the proportion of the more expensive active high-boiling solvents is usually higher. Hot lacquers are more costly, by 20-23 per cent, than those for use under normal conditions.

Another factor is that atomised particles of a hot lacquer increase rapidly in viscosity, so that they do not wet the work so readily as a lacquer applied under normal conditions. The operative is likely automatically to apply more material per unit of area. The additional cost may be considerable.

U.S. ATOMIC RESEARCH

Increasing Influence on Chemical Procedures

THE scale now reached by national atomic energy research projects in the U.S.A. is reflected in the totals of scientific manpower and money employed in the work described in the current semi-annual report of the U.S. Atomic Energy Commission. This is the seventh in the series of reviews presented to Congress and shows that the main departments of research alone will spend about $81 million this year and monopolise the services of 5400 scientists.

This does not, of course, represent the entire American effort. There are large auxiliary undertakings concerned with classified research, Services' uses and commercial applications. Of the total effort by all these interests no true estimate can be formed.

The main State allocation of dollars is being divided in almost equal proportions between two sections, research in physical sciences ($31 million) and development of reactors ($33 million) and $17 million will be used for biological and medical science. Very much more will in fact be spent by official agencies this year in the U.S.A., taking into account the large expenditures additional to current research, including such items as £41 million for construction required for reactors and $25 million for new physical research facilities.

The AEC report is amply reveiwed by *Chemical and Engineering News* (*20*, 537-539). This points to the fact that a sizeable portion of the problems of atomic energy development are chemical in nature. In most studies of atomic nuclei, chemistry plays some part and in others it plays a major rôle. This is particularly true in the handling and processing of special materials that result from nuclear reactions, or are essential to bring them about.

Exploring the Unknown

Most chemical research conducted by the AEC is directed toward solving practical problems. In many cases this involves development or adaptation of already understood principles of the behaviour of atoms and molecules. In other instances, however, the principles are so new that the work of the chemists is essentially basic in that it involves explorations in unknown regions.

Much of the chemist's work in the field of atomic energy comes under the deceptively simple heading "chemical separation." The separation or extraction of one material from another, or more often from a mixture of others, had to be resolved in order to make the bomb possible. Similarly, future progress is dependent on more effective means of carrying out complex separations.

In the U.S.A. the AEC has sanctioned the use of some uranium metal in commercial laboratories. This 4-in. rod of uranium is used by Dr. W. Davidson in the B. F. Goodrich research centre

With the exception of two series of elements, the chemical properties of elements are dependent to a great extent on the number of electrons in the outer shell. In such cases there is a fairly sharp change in chemical properties between elements.

In the rare earth series (cerium, No. 58, lutecium, No. 71) and in the radioactive series comprising actinium (89), thorium (90), protactinium (91), uranium (92), neptunium (93), plutonium (94), americium (95), curium (96), and berkelium (97), such sharp changes are not evident.

In these two areas successive elements are built up, not by additions to the outer shell, but by various additions and adjustments to the inner shells. It is in these two families of elements that separations in a pure form are difficult.

The prime objective of the chemical research programme is to gain a greater understanding of the chemical characteristics of the heavy element transition series. Knowledge gained about some of these elements has assisted in dealing with the chemistry of others in the same series. Since available samples are often of the order of a few millionths of a gram, their chemical properties are most often studied by tracer methods based on their radioactivity. Preparation of protactinium and americium in a metallic form in very minute amounts has been accomplished. The separation of these elements from each other and from the rare earth fission products has involved detailed studies of methods. The separation problem has been quite pronounced in the case of the newer man-made elements, 95, 96, and 97. These studies have resulted in marked advances in the technique of ion-exchange.

Extracting Plutonium

The immediate practical value of the improved separation techniques is in solution of the very pressing problem of extracting plutonium from the uranium slugs used in the Hanford reactors.

AEC chemists consider the plutonium separation the most difficult problem ever undertaken on a large scale. Not only is the amount of the metal in the slugs very minute, but it is mixed with 40 or more elements from which it must be separated.

Typical problems which must be faced include the dissolving of plutonium, precipitation from dilute solution, extraction of plutonium and uranium compounds from aqueous solution by non-aqueous solvents, and the preparation of plutonium metal from its salts. Interference effects resulting from the presence of 40 to 50 other elements, especially the rare earths, which are not commonly encountered in chemical separations, must also be determined.

Rare Earth Elements

In an attempt to solve some of these problems, much research has been carried out on the chemistry of the 14 rare earth elements. Prior to 1940 little work had been done in this field due to the lack of practical value of the elements and the difficulties involved in separating them.

As a result of much fundamental, experimental, and theoretical chemistry, AEC chemists developed a refined ion-exchange process to effect the separations. In this process, a solution containing rare earth elements is allowed to flow downward through a long thin vertical tube which is packed with resin. This solid resin removes the various elements from solution by the process of ion exchange.

After the rare earths are absorbed on the resin, a weakly acid sodium citrate solution is poured through the column. Under the action of this solution, the grip of the resin upon the rare earths seems to be loosened, but in a slightly different degree for each rare earth element present.

As the solution passes down the tube the rare earths begin to be carried with it, but at different rates, so that the solution as it emerges from the bottom of the column is found to carry one rare earth for a time, and then another for a time, then a third for a time, and so on. By collecting these fractions in different vessels, a separation of the component rare earth elements is effected.

The chemist, who must be protected by several feet of concrete, views his materials with mirrors and periscopes and carries out his work by remote control. Use of the ion-exchange process was instrumental in discovering the rare earth promethium (element 61) and also in producing the first appreciable quantities of technicium (element 43). This ion-exchange reaction has now been applied to other fields where separations are difficult, such as the nucleic acids.

Complex Absorption Spectra

The determination of how atoms interact to form molecules is an important objective. Because of the many shell electrons involved in the interactions of most atoms, absorption spectra are quite complex. The complexity often precludes the making of basic theoretical calculations based on studies of such spectra. For this reason, the relatively simple hydrogen molecule is the object of considerable spectroscopic study.

Now that tritium (hydrogen 3) is available, comparison studies and interpretations may be made from studies of various combinations of hydrogen, deuterium, and radioactive tritium. Recent attempts to photograph hydrogen spectra containing tritium have been quite successful.

One of the major problems in the high temperature work is to find refractory materials capable of withstanding the extremely corrosive effects of most molten metals. Research established that certain cerium sulphides and sulphides of other metals had desirable properties.

Progress has also been made in this field by combining predictions based on thermodynamic principles with known data as to the behaviour of materials on the surface of the sun and stars and the study of geological processes which took place at elevated temperatures.

GERMAN UNDER-WATER PAINTS

Useful Findings of Wartime Research

THE important German research on under-water paints during the war, which was greatly intensified by increased submarine activities, is the subject of a report recently issued by an Allied Commission of Investigation. It deals largely with the paints used by the German OKM (Oberkommando der Marine).

In *Farbe, Lacke u Anstrichstoffe* (1950, 4 (2), pp. 39-42) this report is supplemented and criticised by P. Colomb. He refers first to a series of articles by Dechaux on sea-water paints (*Peint. Pigm. Vern.*, 1942, January, October, November; *La Chim. des Peint*, 1948, October) in which the double action of sea-water is stressed, *e.g.*, similar to that of two liquids of *p*H 4 and 11.

Red lead is of little use, he maintains, unless care is taken to use the right kind of formulation to avoid porosity. Colomb had previously reported that the use of chlorinated rubber as binder, in a 3-months' test, resulted in a rise rather than a fall in *p*H.

Before the war, Schweinfurt green (copper metarsenite and acetate) was largely used in Germany as a base for underwater paints, but later, with the intensification of submarine activities, there was considerable difficulty in obtaining sufficient raw materials of the right kind. This was emphasised in the Allied report. In particular, rosin (colophony) was scarce and an attempt was made to obtain substitutes from tall oil. Another shortage was glycerin.

Type G 401

The composition of the anti-corrosive paint Type G 401 is described in the report. The zinc oxide used contained about 6-7 per cent lead, and the iron oxide red was synthetic. The lacquer medium, intended for gray and reddish-brown paints, contained, in parts: 380 Albertol resin 369 Q, or a mixture of this with 347 Q; 147 xylol; 73 tetralin; 67 Syntol T; 190 tetrachlornaphthalene (Haftax); and 190 Nibren wax (I.G.). This was sometimes further diluted with xylol.

Viscosity of the paint was 45-50 sec. in the German standard (DIN) beaker 4 at 20°C. It was dust-dry in one hour and completely dry in 6 hours. The formulation might also include titanium white.

The report also contains the recipe for anti-fouling paint No. 822D, in which the medium used was lacquer 802. The correct formulation of the lacquer is given as (in parts): 40.7 rosin, 8 special resin, 31.2 copper naphthenate—in 75 per cent benzine solution, 7 xylol, 3.3 tetralin, 1 triethanolamine, 12.2 coal tar pitch solution, 33 special medium L30.

Viscosity of the lacquer medium was 25-28 (German standard at 20°C.) and that of the paint was again 45-50. The paint contained talc, which was often used in German war paints to compensate the lack of chromates and improve adhesion.

Red Lead as Pigment

Dr. Kurt Herbert is stated to retain faith in red lead as pigment, but Colomb disagrees and cites support by English and American paint experts. The criticism assumes that the pigment is used with linseed oil with a special binder. His own experience and that of the German railways has shown that red lead makes an excellent paint, if used with an alkyd resin and dehydrated castor oil, with some natural heavy spar (baryta) as filler.

Colomb doubts whether chlorinated rubber was used to any great extent, owing to lack of suitable raw material. Warnecke and Böhm employed a resin known as Ikarol, but this was, in fact, Albertol 347, a condensation product of rosin with diphenyl propane and *p*-formaldehyde.

The best results were generally obtained by using modified phenol resins, by-products of synthetic fatty acid manufacture, cumarone-indene resins and coal tar pitch as binders. The principal anti-fouling agents were pure electrolytic copper and the mercury-copper mixture. The value of tetrachlornaphthalene in these formulations is also noted.

It is pointed out that, in England and America, copper and mercury paints retain their dominant position and zinc chromate is receding in importance. In France, the principal basic materials appear to be Schweinfurt green and other arsenious substances, as before the war.

Saudi-Arabian Oil

According to latest estimates made by the Arabian-American Oil Company, oil production in Saudi-Arabia will average about 463,000 barrels per day in 1950—slightly less than the average production for 1949.

Toxic Factor in Agenised Flour

Steps Which Led to its Recent Isolation

by R. W. MONCRIEFF

QUITE recently, the toxic factor in agenised flour has been isolated, apparently independently, by three groups of workers. Its chemical identity has not yet been precisely determined, but some general indications of its nature have been elucidated.

Canine hysteria, running fits or "fright disease," has been observed in the dog population since 1916 in the U.S.A. and since 1924 in the U.K. The disease is characterised by the occurrence of fits resembling those of epilepsy and, since it was first observed, its incidence has greatly increased; the veterinary aspects of the subject have been discussed by Hewestone.[1]

First Approach

Considerable attention was paid to the disease, and experimental work soon showed that its onset was closely connected with the diet of the animal. A significant advance was made by Arnold and Elvehjem[2], who showed that fits were produced in young dogs if given a diet prepared from wheat flour and meat scrap processed by dry heat. They found, too, that the symptoms could be alleviated by adding an unheated protein to the ration.

The next important step was an observation (unpublished) by Parry that commercial wheat gluten rapidly produced intense symptoms of hysteria in dogs. This was followed up by Wagner and Elvehjem[3], who came to the conclusion that the cause of the disease lay in some toxic factor in the wheat products. This was a distinct advance as, formerly, it had been more usual to ascribe the trouble to a deficiency of some factor in the diet. This was the first clear appreciation of the fact that the disease was, in fact, due to the presence of some poisonous material, and that this was to be found in wheat flour.

Considerably earlier than this, records Sir Edward Mellanby,[4] the idea had developed at the Nutrition Building of the National Institute for Medical Research that the cause of canine hysteria lay in the bread portion of the diet, and it had been possible to stop the onset of fits by changing the source of the bread, or by substituting oatmeal for a considerable proportion of the bread. A miller, to whom samples of flour, suspected of being responsible for outbreaks of canine hysteria, were shown, observed that all these samples had been heavily bleached and probably "improved." This opened up the line of attack which eventually led to the solution of the problem.

Attention was immediately directed to those chemical agents used in the preparation of flour, and of these the following possessed both bleaching and "improving" properties: chlorine, chlorine and nitrosyl chloride (beta gas), nitrogen trichloride (agene), and chlorine dioxide (addage). It was known that of these substances agene was most widely used; indeed, it was estimated that 90 per cent of the flour milled and used for bread-baking in the U.K. had been agenised; *i.e.*, it had been treated with nitrogen trichloride gas. As this processing was known also to affect the gluten of wheat, it was natural that it should be the first to be investigated.

Commercially agenised flour—flour that would normally have been made into bread for human consumption—was used for the tests along with untreated flour. The diet used was one known to be adequate and compatible with normal growth; it contained cereal (agenised in the tests, untreated in the controls), lean meat, arachis oil, bakers' yeast, salt and vitamins A, C and D. The cereal part of the diet was steamed for 90 min. at a pressure of ½ lb.

Conclusive Results

According to Mellanby[4], it soon became evident that the hysterical conditions could often be produced by the above diet if it contained the treated flour, but not if it contained the untreated flour, and again, changing the flour in the diet of a badly affected animal to the untreated variety resulted in a sudden stoppage of the fits; but the animal might remain nervous and shy for a period. Experiments confirmed these findings.

The agenised flours used in the investigation were not specially prepared, over-bleached specimens, but had all received a normal commercial processing. The behaviour of the dogs suggested that the agenised flour, or rather the toxic constituent which it was believed to contain, had affected the central nervous system of the animals. *Post-mortem* examination of

those animals which died during test failed to reveal any lesion which could be regarded as the essential one. It at once became clear that investigation should be made as to the effect on other animals, and particularly on human beings, of flour that had been treated with nitrogen trichloride.

In a later paper Mellanby[5] showed that the portion of the flour which was changed by processing with nitrogen trichloride was the gluten. The gluten was prepared by making the flour into a dough, putting this in muslin and washing out the starch under a cold water tap. It was soon found that if gluten prepared from agenised flour was added to a dog's ration, the animal developed hysteria in a matter of four or five days. The substitution of gluten prepared from untreated flour for that made from agenised flour soon cured the animal.

It was thought that as the gluten contained a considerable proportion of the fatty content of the flour, the toxic factor might reside in the fatty part of the gluten, but this proved not to be the case, as ether extracts were harmless, and toxic gluten was still toxic even after having been extracted with alcohol and ether.

It was abundantly proved that the cause of canine hysteria lay in the gluten of agenised flour, and Mellanby[5] states that a film illustrating the effect of gluten from agenised and untreated flour on the production and cure of canine hysteria was shown at the Ministry of Health on January 20, at Vanderbilt University on April 1, and at the International Physiological Congress in July 1947.

Varying Effects

Mellanby's original experiments[4] were made on dogs, and in his later paper[5] he reported that ferrets were similarly susceptible to the effects of agenised flour. They became drowsy and ill-tempered, had fits of charging hysterically round their cages, and when severely affected, developed true epileptiform fits. Rats appeared not to develop nervous symptoms when fed on agenised flour, but it is, of course, not impossible that natural selection has had something to do with this.

Even among dogs, which are especially susceptible to the effects of agenising, the susceptibility varies from litter to litter and even from one animal to another. Very possibly similar variations existed in the original rat population, and during the last 25 years those individuals that were least affected by agenised flour have thriven and multiplied. Newell *et al*[6] have shown that cats are affected, and Radomski *et al*[7] that rabbits also can develop symptoms of hysteria when fed on a diet containing agenised flour. Moran[8] reported that the guinea pig was unaffected by agenised flour, but that the life cycle of the flour beetle (*Tribolium confusum*) was lengthened by it (*i.e.*, development was retarded).

Human Disorders

The obvious question arises as to the effect that the agenising of flour has had on humans in the last 25 or 30 years. Probably most of the bread we have eaten has been made from agenised flour, and it seems not unreasonable to think that some of the nervous disorders which have been prevalent in that period may have been at least partly due to the use of flour so treated. Cases of idiosyncrasy have probably arisen and it seems likely that some individuals may have been very detrimentally affected.

It is impossible now to gauge what (if any) ill effects have resulted. That there are some grounds for believing that these may not have been inconsiderable is evident from the abolition of agenising in the U.S.A. some years ago, and the more tardy action taken in the U.K. Some kinds of flour, notably wholemeal varieties, appear never to have been agenised. Now that the process is being discontinued, it will be interesting to see if nervous disorders become less prevalent among the human population.

Moran[8] published a long paper in 1947 on work which he had carried out at the Cereals Research Station (St. Albans) of the Research Association of British Flour Millers. In the main, his work confirmed that of Mellanby. He investigated the possibility of the agenising process destroying some essential nutritional factor, but concluded that this is unlikely and that the harmful effects of agenised flour result from the presence therein of some toxic factor. He also showed that when amounts of nitrogen trichloride, larger than those that would be used in commercial practice, are applied to flour, the resulting flour can produce canine hysteria within 24 hours.

Moran does contribute something new in an investigation of the part of the wheat that is acted on. He points out that the reaction of the nitrogen trichloride is with the protein of the wheat—the fraction that Mellanby had described as gluten—and that it is not with a sterol, because the evaporated chloroform and acetone extracts of agenised flour are quite harmless, and they would contain the sterol fraction.

It was pointed out by Moran that the proteins of wheat are not well defined, and he therefore carried out experiments on the treatment of other proteins with nitrogen

trichloride; those he chose were casein, gelatin and zein. Treated gelatin when fed to dogs induced slight running fits; it had a positive, although only a slight, effect. Treated casein and treated zein both produced convulsive fits in about 24 hours. Evidently the toxic factor which results when wheat flour is agenised is also formed when other proteins, such as casein and zein, are treated with nitrogen trichloride.

Amino Acid Effects

Moran was unable to say to which of the amino-acids present (combined) in the protein the toxic factor was due, but he pointed out that zein is said not to contain glycine, tryptophane and lysine in significant amounts, so that perhaps one might rule out these three amino-acids. Moran did, however, also make the tentative suggestion that glutamic acid might possibly be the amino-acid involved. This acid predominates in cereals and in casein, but is present in only small amounts in gelatin, circumstances which agreed with Moran's experimental observations described above. He remembered, too, that the feeding of glutamic acid to epileptic children had recently been found to have beneficial results.

It was also pointed out by Moran that nitrogen trichloride could act chemically either as an oxidising agent:

$$NCl_3 + 3H_2O \rightarrow NH_3 + 3HOCl \rightarrow NH_4Cl + 2HCl + 3O$$

or $2NCl_3 \rightarrow N_2 + 3Cl_2$

or as an addition agent at a point of unsaturation:

$$NCl_3 + >C - C< \rightarrow >\overset{NCl_2}{C} - \overset{Cl}{C}< \rightarrow >\overset{NO}{C} - \overset{Cl}{C}<$$

There is some evidence that in its action on flour, nitrogen trichloride exercises both functions, oxidation and addition.

A paper by Moran *et al*[9] describes the concentration of the toxic factor in agenised zein. The concentration method consists of several stages, and as these are passed the toxic dose becomes lower and lower, indicating that the toxic factor is becoming more and more concentrated. The starting material is zein that has been treated with nitrogen trichloride, and the way in which the toxicity increases has been represented in a table.

It is evident that this method of concentration has yielded a product that is 2500 times as toxic (and therefore as concentrated) as the original agenised zein. Toxicity was assessed by measuring the minimum quantity that would give rise to convulsive fits in rabbits. The table shows:

Step	Fraction	Toxic Dose gm.	Concentration
1. (Control)	treated zein ...	5	—
2. Pancreatic digestion	dialysate ...	1.5	3
3. Butanol extraction	aqueous phase	1.0	5
4. Phenol extraction ...	phenol phase	0.6	8
5. Acid hydrolysis and butanol extraction	aqueous phase	0.3	17
6. Charcoal and acetone precipitation ...	precipitate ...	0.15	33
7. Electrodialysis ...	middle compartment ...	0.030	170
8. Iron-exchange displacement ...	end fraction ...	0.004	1250
9. Acetone precipitation and silica gel	—	0.002	2500

This work was followed by another paper[10] by the same school. Modifications to their original concentration method were made, and it was found possible to isolate the toxic factor in crystalline form—it proved to be a material that could be recrystallised from aqueous ethanol without disturbing its degree of toxicity; it melted sharply with decomposition at 232° C. (uncorr.); it had an appreciable sulphur content.

The behaviour of the crystalline material with ninhydrin is not quite typical of amino-acids—on filter-paper it gives with ninhydrin on heating a yellow colour turning through brown to purple *only on further heating*. As a further proof that this isolate was in truth the toxic factor of agenised zein, it was found that corresponding material was entirely absent from "unagenised" zein, purified in precisely the same way.

Confirmation

Moran *et al*[11] later reported that the isolate prepared as described above had given satisfactorily toxic results when tested on a dog. A 10-kg dog given 20 mg crystalline material (two parts toxic factor per million body weight) developed all the symptoms of hysteria, including running and barking fits, in less than 18 hours, followed by violent convulsive fits. This confirmed that the crystalline material was, in fact, the toxic factor of the agenised zein.

Ultimate chemical analysis of the crystalline material agreed most closely with an empirical formula of

$$C_5H_{12}N_2SO_3$$

and as the "found" molecular weight was 200, it may be that the above empirical formula is also the molecular formula, in which case the molecular weight is 180. Treatment with Raney nickel gave α-aminobutyric acid, by desulphurisation,

a reaction which suggested that methionine is implicated as the reactive centre. Some support for this view was to be found in the fact, reported by Heathcote[12], that the toxic effect of the crystalline substance on *Leuconostoc mesenteroides* P 60 can be reversed by the addition of excess methionine to the medium.

There appears to be some evidence that the crystals may be a mixture of stereoisomers, of which one is toxic and the other non-toxic. There is, of course, nothing unusual in optical antipodes having very different physiological activities; ascorbic acid and testosterone are two examples of such substances.

A recent paper[13] by Drs. Campbell and Work and Sir Edward Mellanby from the National Institute for Medical Research and Nutrition Building, Mill Hill, has described the isolation from agenised flour of the toxic factor in a crystalline form. This substance has proved to be 33,000 times as toxic as the original flour from which it was isolated, and its enormous toxicity may be inferred from the fact that a quantity as small as 3 mgm., when fed to a ferret over a period of five days, produced severe epileptiform fits. A similar quantity fed in one dose is sufficient to kill the animal; by the same reckoning one ounce of the toxic material would kill 10,000 ferrets.

Same Constitution

Campbell *et al* believe that the toxic factor which they have succeeded in isolating has the same constitution as that which Moran *et al* have isolated from zein, as described above. They believe, too, that both substances are identical in constitution with a toxic crystalline isolate with which Dr. Reiner, of Wallace & Tiernan, Ltd., has supplied them.

This last material was obtained from zein that had, like that from the St. Albans group, been treated with nitrogen trichloride. It appears, therefore, that the toxic constituent of flour that has been treated with nitrogen trichloride has been isolated independently by three groups of workers, although two of these groups have used zein, and the third has used flour, as raw material.

The method used by Campbell *et al* for isolating the toxic material from agenised flour was as follows: Wheat flour was agenised with ten times the quantity of nitrogen trichloride used in commercial practice. At this stage 100 gm. (less than 4 oz.) of the flour, when fed to a ferret over a period of three days, proved to be toxic. The gluten, in which the toxic factor was known from previous work by Mellanby[4] to reside, was isolated from the flour, and was digested first with pepsin and then with trypsin, both of these substances being hydrolysing agents.

Chemical Method

The products from this treatment were subjected to dialysis, and the part that dialysed was given a further hydrolysis, this time with concentrated hydrochloric acid; it was then electrodialysed. The neutral electrodialysate was treated with active carbon to remove the aromatic amino-acids, and the residue was passed down an adsorption column of Zeocarb 215. This adsorption separation technique was successful, and a fraction was isolated from the column which had a very high toxicity. At this stage the toxic factor had been greatly concentrated, but had not been isolated; in fact the concentrate still contained 15 different amino-acids. Final concentration and separation were achieved by selective adsorption on a chromatographic paper column.

The precise nature of the toxic material is still unknown, but it seems to have some not very distant connection with the amino-acid methionine. Campbell *et al* thought it likely that the toxic substance would prove to be a peptide, in which case it should, on hydrolysis with a concentrated solution of hydrochloric acid, break down into a number of amino-acids. When, in fact, the substance was hydrolysed and the hydrolysate was examined chromatographically, it was found that although several amino-acids could be detected, there persisted for a long time a portion of the unchanged toxic material. This degree of resistance to the action of hydrochloric acid is much greater than one would expect in a peptide.

The following amino-acids were found in the hydrolysate: homocysteic aicd, α-aminobutyric acid, methionine sulphoxide, methionine sulphone, and homoserine. These strongly suggested again that the toxic factor must be similar in constitution to methionine. Furthermore, both the toxic factor and methionine, when desulphurised by the action of Raney nickel, yield α-aminobutyric acid.

It is, however, known from the work of Silver *et al*[14] that when methionine is treated with nitrogen trichloride, the toxic factor does not result. Furthermore, when Campbell *et al*[13] treated the under-noted amino-acids with nitrogen trichloride, the toxic factor again failed to appear: methionyl-glycine, carbobenzoxymethionyl methionine amide, and carbobenzoxymethionyl methionine. The characteristic crystalline appearance of the toxic factor suggests that it is probably one simple

chemical entity, and it is clearly closely related to the sulphur-containing amino acids.

Among the recent annotations in the *Lancet* is one[15] in the nature of an obituary on agenised flour. It relates how, after Mellanby's discoveries, the U.S. and Canadian Governments prohibited its use in favour of chlorine dioxide, and how in this country a committee was set up under the chairmanship of Sir Wilson Jameson, and including representatives of the Ministries of Food and Health and of the Medical Research Council and the milling industry, to consider the whole problem.

Official Reactions

According to a statement issued by the Ministries of Health and Food at the end of January this year, this committee was unable to find any evidence that agenised flour is in any way toxic to man. It is stated that experiments carried out both here and in the U.S. have failed to produce toxic symptoms, even when heavily treated flour has been fed at a high level. Nevertheless, the committee has decided that its use should be discontinued.

It is suggested that chlorine dioxide should be used as an " improver " instead of nitrogen trichloride, and it is stated that exhaustive tests on flour treated with this improver have shown that it causes no toxic symptoms in either man or animals. The statement concludes with the reassuring remark that the public can be assured that the present methods of treatment of flour, which have been in operation in this country, the U.S.A. and Canada for some 25 years, and which include agenisation, have not proved to be injurious in any way to human health.

Nevertheless, it is felt there must have been some cases of idiosyncrasy, cases of individuals who were much more susceptible than most of us to the toxic factor. The change-over from nitrogen trichloride to chlorine dioxide—which latter substance is bought with dollars—will not be made *in toto* at once, but when it has been made, it will be of great interest to ascertain if there are any discoverable differences in the health of the population.

In conclusion, perhaps reference may be made to a letter[16] recently addressed to the editor of the *Lancet*, in which the view is put forward that "improvers" are not necessary to safeguard baking qualities. " They are merely artificial means to speed up the natural maturing of flour, at the same time bleaching it and giving a whiter-*looking* loaf."

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SPAIN'S KAOLIN INDUSTRY

THE rate of development of exploitation of Spanish kaolin is reflected in part by the fact that in 1948 Spain's imports of this material amounted to some 10 kg. Prior to the Civil War, Spanish kaolin imports totalled 20-25 tons a year.

These facts are recalled by C. Coma Diaz, reviewing in *ION* (December 1949) recent progress in the recovery and use of Spanish kaolins. Fairly large deposits are located in Galicia at Pontevedra, in the north of Lugo province and other parts.

Exports of kaolin from Spain have increased in recent years, although they amounted only to 689 tons in 1948. Production capacity at present is said to be in excess of demand.

Some account is given of composition and of associated minerals which include montmorillonite (bentonite), anauxite, etc. Analysis shows rather wide divergence in composition, especially in moisture content. The principal constituents, with small percentages of Fe_2O, MgO, K_2O, and Na_2O, are given in the following table:

Source	SiO_2	Al_2O_3	Water
S. Martin de Montalban (Toledo)	56.85	28.14	16.6
" " "	47.10	37.11	13.4
Otero "de los Herreros (Segovia)	49.50	35.86	9.78
Valdeprados (Segovia) ...	47.78	39.20	8.82
Liria (Valencia)	55.68	31.10	9.49
Liria (Valencia) (other deposits)	58.62	32.36	5.19
Lage (Pontevedra) ...	45.40	36.63	11.76
Catoira (Pontevedra) ...	47.13	34.56	14.33
Sierra Guadarrama (Madrid)	50.91	31.58	13.59
Melilla	28.18	34.20	31.15

These samples were in most cases crude clays prior to washing, and they compare very favourably with imported material. Some of them have no titanium oxide and in most the content of iron oxide is less than 1 per cent.

Technical Publications

CHARACTERISTICS and applications of anhydrous borax, $Na_2B_4O_7$, are described in a leaflet just issued by Borax Consolidated, Ltd., London. In vitreous enamel and pottery frits an increase in output of frit up to 30 per cent is claimed with Dehybor anhydrous borax, while in the glass industry it melts quietly and without intumescence at about 741°C., largely overcoming the mechanical loss through expansion likely to occur with hydrated borax.

* * *

NOVEL methods of presenting various subjects were employed at the second training conference of the British Iron and Steel Federation, a full report of which has just been issued. "Training the Junior Operative" was presented as a symposium with rehearsed interruptions; "Training the Foreman" was a dramatised committee discussion and "Training the Clerk" a duologue. There were 12 discussion groups. Voting showed that while the majority appreciated these new techniques, a substantial minority did not.

* * *

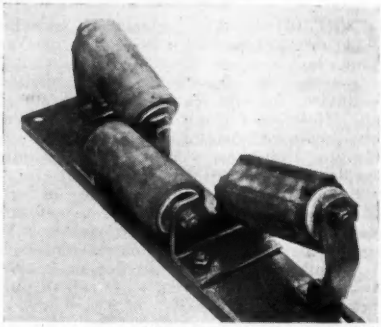
FULL proceedings of the conference on safety in chemical works which aroused considerable interest when it was held at Harrogate in October last year, have now been published in book form and are available not only to members of the Association of British Chemical Manufacturers but to anyone interested. Subjects discussed were: Industrial Hazards (Dr. J. Gwynne Morgan); Safety Aspects of Chemical Plant Design (J. E. Braham); Principles of Safety Organisation (H. R. Payne); Accident Records (H. G. Winbolt); and Clearance Certificates (A. G. Palmer). The book now available from the ABCM (5s.) presents all these papers in full.

* * *

INCREASED sales and production of fluorocarbon-type thermoplastic have enabled the M. W. Kellogg Co., New Jersey, U.S.A., to reduce prices by about 50 per cent. Low-density moulding powder now costs $13.75 lb. compared with $26 lb. for the same quantity. The Kellogg Company has issued a new technical bulletin, on physical and mechanical properties of the material, incorporating experience and data of further tests and industrial applications.

* * *

RECORDS on the volume and value of external trade of Great Britain are given in a new statistical bulletin *Report on Overseas Trade* prepared by the Statistics Division of the Board of Trade. Much valuable information is given in compact form by re-sorting and classifying material from the trade returns and other sources. The report will be published monthly by the Stationery Office (price 1s.).



[Courtesy, Richard Sutcliffe, Ltd

New rapping roller (right) for clearing conveyor belts, particularly necessary where fine materials are belt-carried

* * *

WHAT is in itself almost a small reference library on water treatment has been issued in a series of pamphlets by the Permutit Co., Ltd., London. Aspects covered include: properties and instructions for using cation and anion exchange materials; ion exchange materials in process industries; and ion exchange in research and industry and its miscellaneous applications.

Heterogeneous Catalysis

A general discussion on heterogeneous catalysis, organised by the Faraday Society, is to be held at the New Arts Theatre, University of Liverpool from April 12-14. Sir John Lennard Jones will preside. As an introduction, the Spiers Memorial Lecture, the first to be delivered since the war, will be given by Professor H. S. Taylor, professor of physical chemistry at Princeton University, who will speak on "Surface Catalysis: Retrospect and Prospect."

Forty-two papers have been prepared under the following main headings: theories of adsorption and properties of surface layers; adsorption and catalysis on metals; adsorption and catalysis on oxides; and techniques.

"GLASSWARE MONOPOLY"

Health Minister's Changes

CRITICISM of the glassware manufacturers was made in the House of Commons last week by Mr. Aneurin Bevan.

During the debate on supplementary estimates for the National Health service the Minister of Health, after dealing with the increased costs of hospital services and denying that these were due to maladministration, made this statement:—

"The supply organisation of the Ministry of Health attempted to get bulk purchase of glassware in hospitals. We asked for tenders from manufacturers in Great Britain. We could get no tenders because they said 'We always sell through retailers.'

"We asked the retailers, but they said 'We do not tender because we sell at the price fixed by the manufacturers.' So we had to get them from Germany to break the monopoly. As a consequence we have saved a large sum of money, even after paying import duty."

The British Chemical Ware Manufacturers' Association said that this statement by Mr. Bevan gave rise to certain misapprehensions which it wished to correct. The association issued the following statement:—

"In the first place, there was and is no difficulty in obtaining the bulk of the general types of glassware required by hospitals direct from the manufacturers. The Ministry of Health invited tenders for scientific glassware from the manufacturers, who informed the Ministry that ample supplies were available through the normal trade channels.

"The value of the tenders received by the manufacturers would have made it impossible for the Minister to have saved a large sum of money by importing from Germany."

PARLIAMENTARY TOPICS

State Grants for Technology

DETAILS of arrangements to assist Universities in setting up post-graduate schools in various branches of technology were the subject of a question by Mr. J. M. C. Higgs to the Chancellor of the Exchequer. In a written answer, Sir Stafford Cripps stated that at the suggestion of the University Grants Committee a number of universities were instituting or expanding post-graduate courses of advanced instruction in technological subjects, which included the three main branches of engineering, metallurgy, mining and chemical engineering. To meet the cost of these courses additional recurrent grants had so far been promised of the following amounts: 1949-50, £15,500; 1950-51, £42,000; 1951-52, £57,000. These special arrangements were additional to the normal programmes of post-graduate study being carried on by the universities with the aid of the quinquennial grants announced in 1947. Other courses were under consideration.

UNDERGROUND gasification was again the subject of questions in the House of Commons last week when Mr. Roland Robinson asked the Minister of Fuel and Power what progress was being made and in view of experiments already completed in America, whether any interchange of information with the U.S.A. had been arranged. Mr. Noel-Baker, replying, said the boring at Newman Spinney, near Chesterfield, had begun well, and although it was too early to forecast the result, it was hoped to solve some of the technical problems. The American experiments had been attended by some of our experts, and it was hoped to work in close relationship with the U.S.A. and with Belgium, where similar work had been undertaken.

No Ready-Made Training Schemes—Sir Robert Robinson

THE view that there is no simple solution which would satisfy all the needs recognised by the current desire to increase facilities for technological education was expressed last week by Sir Robert Robinson. The president of the Royal Society told members of the Oil and Colour Chemists' Association—whose principal guest he was at the annual dinner in London—that Sir Henry Tizard is shortly to call together a body of influential people to discuss technological education and it was important that the oil and colour chemists' experience in the matter should be made available in these discussions.

There was yet insufficient data to form any useful conclusions, but of one point he was sure. It was an extremely complex question and the solution would differ from industry to industry. It would need to be a fairly gradual growth, a natural one and not something suddenly brought into being.

· PERSONAL ·

Dr. E. H. T. Hoblyn, whose appointment as director of the British Chemical Plant Manufacturers' Association was announced in our last issue

THE appointment of DR. W. D. SCOTT as deputy managing director of Monsanto Chemicals, Ltd., was announced last week by the managing director, Mr. E. A. O'Neal, Jnr. Dr. Scott joined Monsanto from the Anglo-Iranian Oil Company as a research chemist in 1936. In 1937 he became responsible for Monsanto's technical development and service. In 1942 he was appointed chief chemist in charge of research, development and patent activities. He became a director of the company in 1948. Dr. Scott is an associate of the Royal College of Science, where he obtained his D.I.C. and Ph.D., and a graduate of London University.

MR. C. B. WOODLEY, who has completed this month 25 years' service as general secretary of the British Association of Chemists, is to be released for a time from his secretarial duties in London to tour some of the Northern branches of the association. He intends to promote better liaison between the various sections and headquarters. On March 31 he will meet Leeds members at the Hotel Metropole, and on April 1 he will be received by members at the Grand Hotel, Sheffield.

MR. W. G. B. GRANT has been appointed to manage the new Glasgow branch office, at 158 Cyde Street, C.1, of the Clayton Aniline Co., Ltd., Manchester. The firm's representation in Scotland was previously in the hands of MR. J. M. GIFFORD (A. W. Wardrop & Co.), who, after a long period of co-operation with the Clayton Company, has decided to retire from active participation in the dyestuffs business.

The names of delegates from the United Kingdom, attending the fifth meeting of the International Tin Study Group, currently being held in Paris, were announced last week by the Ministry of Supply. They are: MR. W. G. FERGUSON, Ministry of Supply, Messrs. S. CAHN, S. WAITE and P. O. WILLIAMS, non-official advisers, and MISS N. K. FISHER, Board of Trade.

MR. R. J. P. WILLIAMS, of Wallasey, a student of biochemistry at Merton College, is one of 85 students from 25 countries who have been granted fellowships by Rotary International in Chicago. The fellowship will enable Mr. Williams, who has been studying at Merton College for six years, to complete his studies in Uppsala, Sweden.

The first award of the W. H. A. Robertson Medal of the Institute of Metals has been made to MR. W. J. THOMAS and MR. W. A. FOWLER for their paper on "Some Technical Problems Influencing Production Economy in the Rolling of Aluminium" (the Institute's *Journal*, 75, 921-948). The authors are assistant managing director and production manager of manufactured materials, respectively, of The British Aluminium Co., Ltd. The council of the Institute has gratefully accepted an offer by the directors of I.C.I., Ltd., of a donation sufficient to provide an annual medal award as a memorial to Dr. Walter Rosenhain, F.R.S., distinguished British metallurgist and past-president and Fellow of the Institute of Metals.

At the recent annual general meeting of the British Laboratory Ware Association, the following officers were elected for the period ending January 31, 1951:—Chairman: MR. J. E. C. BAILEY (Baird & Tatlock (London), Ltd.); vice-chairman: MR. J. S. TOWERS (J. W. Towers & Co., Ltd.); hon. treasurer: MR. N. MCKINNON WOOD (Griffin & Tatlock, Ltd.); secretary, MR. W. H. ADAMS. All members of council who had served in 1949-50 were re-elected. MR. S. J. KENNEDY (Baird & Tatlock (London), Ltd.) was re-elected convener of the technical committee.

(*continued overleaf*)

OBITUARY

Sir Norman Haworth

THE death occurred on March 18 of SIR NORMAN HAWORTH, distinguished for his research on carbohydrates and vitamin C, for which he shared the Nobel Prize for chemistry in 1937.

Walter Norman Haworth was born in 1883 and studied at the universities of Manchester and Göttingen. After being senior demonstrator in chemistry at the Imperial College, South Kensington, he became reader in chemistry at St. Andrews.

In 1920 he became professor of chemistry and director of the chemistry department University of Durham. Five years later he was appointed to the chair in chemistry, and director of the department of chemistry at Birmingham University, with which he was associated for many years, from 1947-48 as vice-principal.

Professor Haworth did outstanding work on substances connected with the production of immunity against disease. One fundamental contribution was the determination of the chemical structure of pure vitamin C and he showed that it could be produced cheaply on a commercial scale. He bestowed the patent rights on the DSIR. In 1942 he was awarded the Royal Medal of the Royal Society for his fundamental contributions to organic chemistry, particularly to the constitution of the sugars and the structure of polysaccharides

The professor was president of the Chemical Society from 1944 to 1946, and was knighted the following year, when he was also appointed chairman of the Chemistry Research Board.

Although his name was not directly associated with the development of the atomic bomb he was one of the signatories of the Atomic Scientists' Association's memorandum on international control of atomic energy submitted to the Atomic Energy Commission of the United Nations.

Professor Haworth received many honours, including the Davy, Royal and Longstaff Medals. He was elected an FRS in 1928 and became a vice-president of the Royal Society in 1948. He was honorary D.Sc. of Belfast, Zürich and Oslo, honorary Sc.D., Cambridge, and LL.D., Manchester. He was also an honorary member of the Academy of Sciences at Haarlem, Brussels, Munich, Vienna, Finland, Dublin, and of the Swiss Chemical Society.

Lively and energetic, Professor Haworth was an able organiser of research. His achievements were largely due to a devotion to exactitude, his inventiveness in experimental technique and an ability to inspire a research team.

The death has occurred of DR. GEORGE GREEN, a senior lecturer, and for 39 years a member of the staff of the natural philosophy department of Glasgow University. After graduating, he became scientific secretary to Lord Kelvin, with whom he collaborated in some important investigations, and after Lord Kelvin's death he took a large part in preparing the collected edition of his works. During the first world war Dr. Green did pioneering work in sound ranging under Sir William Bragg. He invented a condenser telephone which is a substitute for the loudspeaker in radio, and he was the author of a series of mathematical papers dealing with the solution of problems in the conduction of heat which appeared in the *Philosophical Magazine* over a period of 30 years.

PERSONAL

(continued from previous page)

DR. J. C. DUFF has been appointed head of the chemistry department at Birmingham Central Technical College, in succession to DR. P. D. RITCHIE. Dr. Duff was previously deputy head of the department and, during 30 years' association with the college, has carried out original research on plastic materials.

The appointment is announced of MR. A. IDDLES, president of Babcock & Wilcox Company (U.S.A.), as a director of the British company. He takes the place of MR. A. G. PRATT, who has resigned.

ALDERMAN FREDERICK STATHAM, who had completed 47 years' service with Lever Brothers (Port Sunlight), when he retired three years ago, has been chosen as Mayor of Bebington (Cheshire).

HOME

Gas Engineers' New H.Q.

The Institution of Gas Engineers has removed from 1 Grosvenor Place, London, S.W.1, to 17 Grosvenor Crescent, S.W.1. The telephone number is unchanged.

Varnish Blaze

Over 300 gal. of varnish were destroyed by a fire which occurred on March 16 at the works of McArthur and Jackson, Ltd., oil refiners, 98 Dobbie's Loan, Glasgow. The varnish, in two large pans, was being heated by gas jets when it ignited.

Coal Production

Last week's output of deep-mined coal showed a loss of 25,100 tons over the previous week. This was partly offset by an increase of 8000 tons in opencast production. Comparative figures are: Last week: 4,361,100 tons (deep-mined 4,105,800 tons, opencast 255,300 tons); previous week: 4,378,200 tons (deep-mined 4,130,900 tons, opencast 247,300 tons).

Liverpool as a Rubber Centre

Liverpool may become the centre for the storage and distribution of liquid rubber. Last year the Dunlop factory in Liverpool made three times its pre-war volume of latex foam cushioning. This year, with a new extension, it is hoped to increase the pre-war production five-fold. Exports have been increased by 500 per cent and now go to 99 different markets.

Scottish Whaling

Plans for the revival of the whaling industry in Scotland are now going ahead, despite some criticism. Location of the operations has now been fixed on the Island of Harris which was formerly used as a whaling point. It is expected that the company, Scottish Whalers, Ltd., will employ two ships and that after boiling out of the blubber the whale-meat will be cold-stored until marketed.

Another Steel Output Record

Total ingot production of the eight steel works of the West Wales section of Richard Thomas and Baldwins, Ltd., for the week ended March 11 reached 18,954 tons. This exceeded for the second successive week the previous record for these works of 17,976 tons which had been unbeaten since 1937. At Dyffryn the output of 3080 tons was outstanding, being over 300 tons more than the previous best figure. Production at this group of works has been raised from about 12,000 tons weekly three years ago.

Lead Price Again Reduced

A further reduction—by £4 to £84 a ton delivered—in the U.K. price of good soft pig lead was announced last week by the Ministry of Supply. This follows a reduction by £9, earlier in the month.

Winning Ambulance Team

Gaskell Marsh works ambulance team, Widnes, were successful for the fourth consecutive year in the ambulance competition for the Lady Muspratt Shield. Eleven teams, representing the general chemical division of I.C.I., Ltd., competed at Runcorn.

New University Press

The Senate of London University has decided to establish its own press, which will be known as the Athlone Press (after the name of the Chancellor). The difficulty of getting learned works published since the war has emphasised the need for an independent press.

Finland Seeks U.K. Fuel, Steel, Chemicals

A Board of Trade Press note announcing the conclusion of the Anglo-Finnish trade talks in London last week disclosed that a considerable increase in the volume of trading by both countries is to be expected. Among Finland's principal requirements from the U.K. are coal, oil, steel, machinery, textiles and chemicals.

Cotton Industry Research

An appeal for £500,000 for a building fund to extend the textile industries' Shirley Institute at Didsbury, Manchester, has been launched by the British Cotton Industry Research Association. If the association can collect £150,000 from subscribers the balance will be made up by £90,000 from its own reserves, £55,000 from the Cotton Board, and £205,000 from the Department of Scientific and Industrial Research. The size of the institute would be nearly doubled.

Synthetics Firm's Expansion

Marchon Products, Ltd., has received permission from the Board of Trade to erect at Whitehaven an additional factory building of 70,500 sq. ft. An extension of office accommodation of 8000 sq. ft. has also been licensed. The company states that the extensions, necessitated by the rapidly expanding home and export trade in synthetic detergents and allied products, should eventually give employment to 500 more workers. Work on the new buildings is expected to start during the next few months.

D

OVERSEAS

New Chinese Salt Monopoly

China's important domestic salt trade as well as exports have been taken over by a new salt monopoly company established by the Communist Government. It hopes to produce, and distribute, about 1 million tons of salt this year.

South African Fish Oil Surplus

Warehouses at the Cape are reported to be overstocked with shark and other fish liver oils. A processing works at Gansbaai has closed down and in other parts the extraction of oil has largely decreased in recent years. Prices have reached a low level.

Metal and Engineering Exhibits

All branches of Belgian industry connected with mines, metallurgy, mechanical and electrical engineering will be widely represented at the second Liége International Fair, from April 29-May 14. A large number of foreign exhibits will be included.

U.S.A. to Buy Ceylon's Oil Surplus?

The U.S.A. has offered to purchase Ceylon's entire exportable surplus of coconut oil until the end of June, 1951, according to information received from Colombo, states *Reuter*. The offer is said to have been communicated to the Government through Ceylon's Ambassador in the U.S.A., Mr. G. C. S. Corea.

$18.5 m. for "Shell" Research

Some $18.5 million will be spent by the Shell oil companies in 1950 in research to develop new chemicals from petroleum and especially agricultural products. The money will support Shell laboratories throughout the world, but the major portion will go to four principal U.S. research centres, notably that in Emeryville, California, which is operated by the Shell Development Company.

Venezuela Restricts Oil Output

The curtailment of crude oil imports by several important U.S. companies has necessitated a voluntary reduction in the output of petroleum by the major concerns operating in Venezuela. It is reported that the reductions may amount to about 20 per cent of Venezuela's exports last year, which were the highest on record. A Government spokesman has pointed out, however, that a much more severe reduction would have to take place before the country's economic position could be seriously affected.

Oil Search in Queensland

The first large-scale attempt to discover oil in Australia has recently begun in Queensland, where the Shell group has started work in what its general manager described as promising oil country. A test well is being sunk possibly to 10,000 ft. and may cost about £1 million.

Element No. 98 Created

A group of scientists in the laboratories of the University of California have created, by atomic bombardment, a new chemical element, No. 98 in the periodic table, the heaviest chemical element known. It has been named californium in honour of the university, where the six heaviest trans-uranium elements, including plutonium, were previously made.

2.5 m. Tons of Indian Salt

India will be self-sufficient in salt in 1951, it was reported in the Dominion Assembly in New Delhi. The estimated production in 1950, said the Minister of Industry, was 70 million maunds (approximately 2.5 million tons), whereas the estimated demand was 65 million maunds. In 1947 India imported 12 million maunds, 12 million maunds in 1948 and 3.9 million maunds in 1949. In 1950 the import would be 3 million maunds.

Paper Plant for Portugal

Construction of a new sulphate pulp and paper mill at Cacia, the first industrial project for Portugal under the Marshall Plan, has been approved by the ECA. The mill will be operated by Companhia Portuguese de Celulose and will have an estimated yearly production of 32,000 metric tons of sulphate pulp. Of the total cost of about $9.6 million some $4 million will be spent in the U.S.A. and over $2 million in the United Kingdom.

Efficient Oil Recovery

A new process of recovering crude oil by a solution process requiring the injection of hydrocarbon gas into reservoirs has been announced by the Atlantic Refining Company, U.S.A. Officials of the company claimed that pilot plant tests had shown that as much as 90 per cent of oil could be recovered, compared with about half that amount which is at present recoverable.

The gas is injected under conditions which promote mutual solution of crude oil and gas. As both tend to dissolve the oil swells beyond the ports enclosing it and is forced to the surface.

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

A. & W. Chemical Co., Ltd., London, E.C. (M., 25/3/50). February 21, £650 deb., to J. A. Peters, Guildford, and another; charged on 1 and 2 Cricketers Court, Lower Kennington Lane, S.E., and a general charge.

E. H. Butler & Son, Ltd., Leicester, manufacturing chemists. (M., 25/3/50.) February 24, £23,000 (not ex.) mort., to Lloyds Bank, Ltd.; charged on factory premises at Thornton Lane, Leicester. *—. December 16, 1949.

Thermal Syndicate, Ltd., Wallsend. (M., 25/3/50.) February 15, series of £80,000 debs., present issue £20,000; general charge. *Nil. April 1, 1949.

Universal Solvents (Brighton), Ltd., Hove. (M., 25/3/50.) February 22, £300 deb., to E. P. A. Smith, Hove; general charge.

Satisfactions

British Celanese, Ltd., London, W. (M.S., 25/3/50). Satisfaction February 24, of first deb. stock and supplemental deed reg. October 2, 1943, and November 8, 1944, to the extent of £6,500.

Francesca (England), Ltd., London, W., manufacturing chemists. (MS., 25/3/50). Satisfaction March 1, of deb. reg. February 20, 1948.

Hornflowa, Ltd., London, E.C., manufacturers of plastic powders, etc. (M.S., 25/3/50.) Satisfaction March 1, of charge relating to 69 John Street, Maryport, reg. April 28, 1948.

Liquids Control, Ltd., London, N.W. (M.S., 25/3/50.) Satisfaction February 28, of deb. reg. April 4, 1949.

Macrome, Ltd., Wolverhampton, metallurgists. (M.S., 25/3/50.) Satisfaction February 28, of deb. reg. November 18, 1948, to the extent of £29,800.

Treforest Chemical Co., Ltd., London, E.C. (M.S., 25/3/50.) Satisfaction February 27, of charge reg. September 15, 1941.

Wellcome Foundation, Ltd., London, N.W., chemical manufacturers. (M.S., 25/3/50.) Satisfactions February 28, part of property (138-144 (even) Gower Street, 25-35 (incl.) Gower Place, 209-225 (odd) Euston Road, St. Pancras) comprised in mortgage and mortgage and charge reg. respectively May 9 and July 29, 1947, having been released from said charges.

Increases of Capital

The following increases in registered capital have been announced:—Factron Products, Ltd., from £100 to £1000, H. & T. Proctor, Ltd., from £25,000 to £40,000, Dextran, Ltd., from £100 to £5000, Turkdean, Ltd., from £50,000 to £100,000.

Company News

Canadian Chemical Result

The Dominion Tar and Chemical Co., Ltd., (of Canada) made a net profit in the year ended December 31, 1949, of $1,811,216 against $2,186,950 in 1948. There is a surplus of $4,599,793 ($3,530,578 at the end of 1948). Expenditure on capital account amounted to $3,298,463 during the year. The new salt plant at Unity, Sask., and the new chlorine and caustic soda plant at Beauharnois were brought into production during the year.

Fisons, Ltd.

The terms of the new debenture issue were announced by the board last week. £3.5 million 4½ per cent first mortgage debenture stock (1965-83) at a price of 98 per cent, is to be offered for public subscription.

Monsanto Chemicals, Ltd.

The trading profit for the year ended December 31, 1949, was £810,021 (£876,700). A net profit of £278,499 (£363,898) remained after taxation, depreciation allowance, etc. The directors recommend a final dividend on the ordinary stock of 30 per cent, less tax, payable May 19, making a total for the year of 45 per cent, less tax. A balance of £448,600 (£423,789) is to be carried forward. The annual general meeting of the company will be held in London on May 10.

Chemical and Allied Stocks and Shares

APART from some expansion of interest in overseas shares, stock markets have remained quiet and generally inactive. The tendency to await the Budget continues. There were only small indefinite movements in British Funds and industrials. Chemical and kindred shares moved narrowly and were inclined to ease, Imperial Chemical to 41s. 10½d., although there is general confidence that the 10 per cent dividend will be maintained. In fact, owing to benefits from the larger capital, it is being expected that the results will show good expansion of earnings.

Albright & Wilson 5s. shares have changed hands around 29s., Boake Roberts were 25s. 6d., F. W. Berk 14s. 3d., Amber Chemical 2s. shares 4s. 9d., Bowman Chemical 5s. 3d., Brotherton 19s. 3d., and Pest Control 5s. shares 7s. 10½d. Elsewhere, Laporte Chemicals 5s. shares showed firmness at 9s. 6d. and Lawes Chemical 10s. shares were 10s. 6d. Monsanto Chemical 5s. shares eased to 49s. 6d. on the reduced profits, although the results created a good impression. The dividend is, of course, maintained at 45 per cent. Fisons have changed hands around 21s. 9d. following details of the new capital terms.

A feature was a sharp rally to 62s. 6d. in British Xylonite, while other shares of companies connected with plastics were mostly firmer, although De La Rue fell to 21s. British Industrial Plastics 2s. shares were 5s. 6d., Kleemann 8s. 1½d., and elsewhere, the 4s. units of the Distillers Co. were 16s. 10½d. Turner & Newall have eased to 76s. 3d. and United Molasses to 37s. 9d., although there has been revived talk in the market of share bonus possibilities in respect of the latter company.

Glaxo Laboratories at 45s. 6d. have been fairly steady, and Boots Drug 5s. shares were 45s. 6d. "ex rights" with the new shares 10s. 7½d. premium. It is generally believed there are good prospects of Boots being able to maintain dividends of 40 per cent on the larger capital.

British Oxygen have been firm at 94s. 6d., awaiting the financial results. British Aluminium were 40s. 6d., and General Refractories firm at 22s. 7½d. on the financial results. There was again uncertainty in Lever & Unilever (41s. 6d.), although there is general confidence that the 10 per cent dividend will be maintained.

In other directions, British Glues & Chemicals 4s. shares kept at 20s. Borax Consolidated were 53s. and Amalgamated Metal steady at 18s. 1½d. Metal Box at 90s. and United Glass Bottle at 68s. 9d. both remained firm features.

Iron and steels have been steadier, Stewarts & Lloyds at 50s. 3d., United Steel 24s. 6d., Hadfields 26s. and Thomas & Baldwins 12s. 9d. Staveley were 75s. 3d., and Tube Investments changed hands up to £5⅝. Associated Cement were firmer at 76s. 3d. at which there would be a yield of 5⅞ per cent on the basis of last year's 22½ per cent dividend. Rugby Cement 5s. shares at 16s. 10½d. have remained under the influence of the higher dividend.

There have been uncertain movements in oil shares which failed to benefit from news of the summer petrol "bonus." Reports have been current that the U.S. is to make a further objection to Britain's ban on oil imports from dollar countries. Shell have eased to 63s. 9d. at the time of writing and Anglo-Iranian also moved back. A sharp rise in Burmah Oil to 60s. reflected hopes of better news in regard to war damage compensation.

Overland Pipeline Proposed

DEVELOPMENT of an oil pipeline crossing Scotland from Loch Long to Grangemouth, to feed the expanded Grangemouth refinery, has been proposed. This project would involve the creation of a major tanker depot and pumping plant at the receiving end and an adjustment in organisation at the Grangemouth end, where it had been expected that oil would be imported by tanker. Grangemouth town council has asked the sponsors of the scheme to plan a different approach to the refinery on the ground that a given area of land will require to be "sterilised" on either side of the pipeline. The present approach cuts through land intended for housing.

Details of the scheme, which it is anticipated will cost about £2½ million, are expected to be announced shortly by the Anglo-Iranian Co. The pipeline will have a capacity of two million tons a year.

Ether Explosion

An outbreak of fire in the factory of Duncan Flockhart and Co., Ltd., chemical manufacturers, Edinburgh, caused by the explosion of a vessel containing ether, caused damage to the ether sealing room before being brought under control.

Prices of British Chemical Products

Fall in Values of Lead Chemicals

THERE has been a steady call for supplies of most of the industrial chemicals and particularly from the textile and plastics industries. Consumers' delivery specifications have been fully up to schedule. The export demand continues at a satisfactory level, the bulk of the shipments being to Empire destinations. Values throughout the market are steady and there are few changes of any importance to record. The reduction in the prices of white and red lead recorded last week have been followed by further reductions. The new basis prices are as follows: Dry white lead £112 15s. per ton; ground white lead £133 10s. per ton; red lead £103 per ton; Orange lead £115 per ton; red lead ground in oil £126 5s. per ton and orange lead ground in oil £138 5s. per ton. Among the coal tar products, pitch is in fair demand and a good interest continues to be maintained in the light distillates. Phenol is now exempt from Key Industry Duty.

MANCHESTER.—Values on the Manchester chemical market have generally been steady. Exceptions were the irregular trend of non-ferrous metals in which there was a decline in lead and a rise in zinc compounds. Contract deliveries to home users of the alkalis and other regular lines have been maintained and there has been a fair amount of new inquiry and actual business during the past week. Shippers' inquiries have been fairly widespread. Most fertilisers benefited from the usual seasonal improvement.

GLASGOW.—There has been a definite increase in business in the Scottish heavy chemicals market, possibly due to the fact that everyone has an eye on the increased railway rates which come into operation shortly. It is obvious that many firms are stocking up materials which come from other parts of Britain. The export market remains fairly steady.

Price Changes

Rises: Antimony oxide, formic acid, iodine, pyridine, soda ash, sodium iodide, zinc oxide.

Reductions: Lactic acid, red lead, white lead, litharge, caustic soda.

General Chemicals

Acetic Acid.—Per ton: 80% technical, 1 ton, £61; 80% pure, 1 ton, £66; commercial glacial 1 ton £71; delivered buyers' premises in returnable barrels; in glass carboys, £7; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £110 per ton.

Acetone.—Small lots: 5 gal. drums, £90 per ton; 10 gal. drums, £85 per ton. In 40/45 gal. drums less than 1 ton, £70 per ton; 1 to 9 tons, £69 per ton; 10 to 50 tons, £68 per ton; 50 tons and over, £67 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots, d/d, 2s. 1d. per proof gallon; 5000 gal. lots, d/d, 2s. 2½d. per proof gal.

Alcohol, diacetone.—Small lots: 5 gal. drums, £133 per ton; 10 gal. drums, £128 per ton. In 40/45 gal. drums: less than 1 ton, £113 per ton; 1 to 9 tons, £112 per ton; 10 to 50 tons, £111 per ton; 50 to 100 tons, £110 per ton; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER: Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non returnable drums; 1 ton lots £40 per ton.

Ammonium Carbonate.—1 ton lots; MANCHESTER: Powder, £52 d/d.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £78 and £76 10s. per ton.

Amyl Acetate.—In 10-ton lots, £171 10s. per ton.

Antimony Oxide.—£160 per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots, as to grade, etc., 1s. 9½d. to 2s. 4¾d. per lb. Crimson, 2s. 6½d. to 3s. 3½d. per lb.

Arsenic.—Per ton, £38 5s. to £41 5s., ex store.

Barium Carbonate.—Precip., d/d; 2-ton lots, £27 5s. per ton, bag packing, ex works.

Barium Chloride.—£35 to £35 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £29 10s. per ton d/d; 2-ton lots, £29 15s. per ton.

Bleaching Powder.—£25 15s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140 lb. bags, carriage paid: Anhydrous, £54; in 1-cwt. bags, commercial, granular, £34 10s.; crystal, £37; powder, £38, extra fine powder, £39; B.P., granular, £44; crystal, £46; powder, £48-£48 10s.; extra fine powder £48.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £62; crystal, £69; powder, £66 10s.; extra fine powder, £68 10s.; B.P., granular, £75 10s.; crystal, £81; powder, £78 10s.; extra fine powder, £80 10s.

Butyl Acetate BSS.—£149 10s. per ton, in 10-ton lots.

Butyl Alcohol BSS.—£145 10s per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £8 per ton, in 4 ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Cobalt Oxide.—Black, delivered, 8s. 5d. per lb.

Copper Carbonate.—MANCHESTER: 1s. 7d. per lb.

Copper Chloride.—(53 per cent), d/d, 1s. 11½d. per lb.

Copper Oxide. — Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(53 per cent), d/d, 1s. 10d. per lb.

Copper Sulphate.—£47 5s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £7 8s. per 1-2 cwt. lot, d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £103 10s. per ton.

Formaldehyde.—£31 per ton in casks, according to quantity, d/d. MANCHESTER: £32.

Formic Acid.—85%, £66 to £67 10s. per ton, carriage paid.

Glycerin.—Chemically pure, double distilled 1260 s.g. £123 per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; bulk carriage paid.

Hydrochloric Acid.—Spot, 7s. 6d to 8s 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—1s. 0½d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 18s. per lb. in cwt. lots.

Iron Sulphate.—F.o.r. works, £3 15s. to £4 per ton.

Lactic Acid.—Pale tech., £70 per ton; dark tech., £60 per ton ex works; barrels returnable.

Lead Acetate.—Nominal.

Lead Carbonate.—Nominal.

Lead Nitrate.—Nominal.

Lead, Red.—Basis prices per ton: Genuine dry red lead, £103, orange lead, £115. Ground in oil: red, £126 5s., orange, £138 5s.

Lead, White.—Basis prices: Dry English, in 8-cwt. casks, £112 5s. per ton. Ground in oil, English, under two tons, £133 10s.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton; grey, 80-82 per cent, ton lots, d/d. £22 to £25 per ton.

Litharge.—£103 per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £70 per ton.

Magnesium Chloride.—Solid (ex wharf), £20 to £25 per ton.

Magnesium Oxide.—Light, commercial, d/d. £160 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 7s. 4d.; smaller quantities dearer

Mercurous Chloride.—8s. to 9s. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. 7½d. per gal.; pyridinised 64° O.P. 100 gal., 3s. 8½d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb. (Nominal.)

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£128 to £133 per ton packed in free 5-cwt. casks.

Paraffin Wax.—From £61 10s. to £101 17s. 6d., according to grade for 1 ton lots.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £61 per ton; B.P. (S.G.1.750), ton lots, carriage paid, 1s. 1d. per lb.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 9¾d. per lb.; ground, 10¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £64 per ton for 1-ton lots, ex store; hydrated, £58 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96 per cent, 6-ton lots, £16.10 per ton.

Potassium Iodide.—B.P., 11s. 1d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 6d. per lb.; technical, £7 9s. 6d. to £8 3s. 0d. per cwt.; according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s per ton; medium, £67 10s. per ton; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid.—MANCHESTER: 1s. 11d. to 3s. 2d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic. — Solid 76/77%; spot, £18 4s. per ton d/d.

Sodium Acetate.—£41-£55 per ton.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 8d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £29 12s. 6d. per ton d/d in 2 ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100 per cent basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite. — Pea crystals £23 2s. 6d. a ton; commercial, 1-ton lots, £21 12s. 6d. per ton carriage paid.

Sodium Iodide.—B.P., 16s. 9d. per lb, in cwt. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £101 10s. ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98 per cent, 6-ton lots, d/d station, £20 10s. per ton.

Sodium Nitrite.—£29 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 16s. 9d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots: Di-sodium, crystalline, £32 10s., anhydrous, £65; tri-sodium, crystalline, £32 10s., anhydrous, £62.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER: £6 10s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot. £24 10s. per ton, d/d, in drums; broken, £25 5s. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £15 11s. 6d. to £17 16s. 6d. according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. to £7 2s. per ton; 140° Tw., arsenic free £4 18s. 6d. per ton; 140° Tw., arsenious, £4 11s. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt: 10 cwt. or more £8 10s.; 5 to 9 cwt. £8 12s.; 2 to 4 cwt. £8 14s.; 1 cwt. £8 16s.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d, (56 lb. bags) £102 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d; white seal, £86 10s.; green seal, £85 10s.; red seal, £84.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 4s. to 5s. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £11-£11 10s. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£56 to £59 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d. to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £36 15s. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermillion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £10 8s.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £10 14s. 6d. I.C.I. Special No. 1, £16 6s., rising by 2s. 6d. per ton per month to June, 1950. National No. 2, £10 18s. per ton.

"Nitro-Chalk."—£10 4s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean for 6-ton lots d/d nearest station, £11 per ton.

Coal-Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 10¾d. to 1s. 0½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 10¾d. to 1s. 0½d. per lb., d/d crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 9¾d. per gal., according to quality, f.o.r. maker's works. MANCHESTER: 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 98%, 3s. 9d per gal.; 99%, 3s. 1d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 3s. 11d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £8 1s. to £12 13s. per ton according to m.p.; hot-pressed, £14 15s. to £15 14s. per ton, in bulk ex works; purified crystals, £28 to £43 5s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 100s. per ton f.o.r. suppliers' works; export trade, £6 to £7 per ton f.o.b. suppliers' port. MANCHESTER: £5 10s. f.o.r.

Pyridine.—90/160°, 21s. 6d. MANCHESTER: 19s. to 22s. per gal.

Toluol.—Pure, 3s. 2d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 2d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—Nominal.

***o*-Cresol 30/31° C.**—Nominal.

***p*-Cresol 34/35° C.**—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb.; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 11d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb.; P.G. 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON: March 28. The prices of all refined oils and fats will remain unchanged during the eight-week period ending on April 22. The price of linseed oil is from £82 to £132 per ton, according to quality; castor oil from £108 to £115; whale oil from £75 to £90. The prices of all other unrefined oils and fats will remain unchanged.

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Next Week's Events

MONDAY, MARCH 27

Incorporated Plant Engineers

Leeds: University, 7.30 p.m. Film by Vacuum Oil Co.: "Modern Methods of Lubrication."

Institution of the Rubber Industry

Manchester: Engineers' Club, 6.15 p.m. H. Whincut: "Polytetrafluoroethylene."

Society of Chemical Industry

Leeds: University, 5 p.m. The Brotherton lecture. Dr. H. H. Hodgson: "The Pilgrimage of a Colour Chemist."

TUESDAY, MARCH 28

The Royal Institute of Chemistry

Welwyn Garden City: The Cherry Tree, 8 p.m. Dr. E. C. Wood: "Analytical Results—Some Facts and Fallacies."

Hull Chemical and Engineering Society

Hull: Church Institute, Albion Street, 7.30 p.m. (with OCCA). L. Griffiths: "Perspex."

The Institute of Fuel

London: Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. M. W. Thring (Head of the physics department, BISRA): "High-Temperature Combustion-Heated Furnaces."

WEDNESDAY, MARCH 29

The Chemical Society

Edinburgh: Chemistry Department, King's Buildings, 11 a.m. Sir Ian Heilbron: "The Chemical Society—A Mid-Century Review." Followed by annual general meeting at 12 noon.

North British Station Hotel, 7.30 p.m. Anniversary dinner, at which the new president, Prof. E. K. Rideal, will be installed.

German Industries Fair

Hanover: Messegelände. Light industries section (until April 2). Details from: EPPAC, Ltd., 2-5 Studio Place, Knightsbridge, S.W.1.

The Institute of Physics

London: University College. Annual conference of stress analysis group. (March 29-31.)

British Association of Chemists

Liverpool: University, (Nicholson Chemistry Lecture Theatre) 7 p.m. Demonstration of scientific instruments.

THURSDAY, MARCH 30

The Chemical Society

Edinburgh: Zoology Department, King's Buildings, 11.30 a.m. Prof. G. Hevesey: "The Application of Radioactive Indicators in Biochemical Studies." (Faraday Lecture).

The Royal Institute of Chemistry

London: Philips Electrical, Ltd., New Road, Mitcham Junction, 7.15 p.m. Dr. W. D. Jones: "The Production of Heat Resisting Materials by Powder Metallurgy."

Leeds Metallurgical Society

Leeds: University, 7 p.m. A member of the research staff of the British Cast-Iron Research Association will present a paper on "Nodular Cast Iron."

FRIDAY, MARCH 31

The Royal Institute of Chemistry

Glasgow: Merchants House, 30 George Square, 10.30 a.m. Annual general meeting. 11.30 a.m.—Presidential address by Prof. J. W. Cook.

University, 2.30 p.m. G. G. Henderson memorial lecture. Dr. W. M. Cumming: "The Growth of Applied Chemistry in Glasgow."

Sheffield: Department of Applied Science, St. George's Square, 6.30 p.m. (with Royal Statistical Society). Discussion: "Variability in Chemical Analysis."

SATURDAY, APRIL 1

The Royal Institute of Chemistry

Glasgow: Works visits during the day. 7 p.m. Central Hotel. Annual dinner. Principal guest: Lord Boyd Orr, Chancellor of Glasgow University.

The British Interplanetary Society

London: Caxton Hall, Westminster, S.W.1, 6 p.m. A. C. Clarke: "Space Travel, Fact and Fiction."

The BAC Dinner

MANY people of distinction in chemistry and chemical and allied industries notified their intention of attending the dinner of the British Association of Chemists, held on Friday this week at Charing Cross Hotel, London. This year's president is Dr. Herbert Levinstein, who was one of the association's earliest presidents, many years ago. Those who accepted invitations included Professor J. W. Cook (Royal Institute of Chemistry), Dr. T. P. Hughes (Chief Chemist, Farnborough Research Station), Mr. F. A. Greene (Institution of Chemical Engineers), Sir Ian Heilbron (President of the Chemical Society) and Dr. L. A. Jordan (Director, Paint Research Station). Sir John Russell, in a goodwill message, declared that the association should be regarded as the modern equivalent of a Guild of Chemists.

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Further particulars may be obtained from the HIGH COMMISSIONER for Ceylon in London, 25, Grosvenor Square, W.1.

Applications for the above post should reach the High Commissioner for Ceylon in London, on or before April 22nd, 1950.

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FILTER PRESS, plate and frame type, with 23 plates forming 24 cakes 30 in. square by 1⅛ in. thick, 2½ in. diam. feed and 2½ in. diam. enclosed discharge.

FILTER PRESS by **JOHNSON,** plate and frame type, with 38 plates forming cakes 28 in. sq. by ⅞ in. thick, 3 in. diam. feed and 2½ in. diam. enclosed discharge.

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